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Morphological Awareness and Spelling Development

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Thesis submitted in partial fulfilment of the requirements of the award of
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Dedicated to my wife, my daughters and son

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When I decided to read for a PhD in Psychology, I was trying to fulfil an old dream. Whenever things got harsh, I remembered the love of my wife and the tenderness in the eyes of all my children.

ABSTRACT

The aim of this thesis is to analyse the relation between morphological awareness and morphologically based spellings, in Portuguese (European Variant).

Two situations where the spelling is determined by morphology are examined: when the spelling flouts letter-sound correspondence rules (consistency in the spelling of stems in base and in derived forms), and when there is more than one spelling for the same sound (discrimination in the spelling of homophone suffixes).

The studies used cross-sectional (studies 1, 2 and 6) and longitudinal (studies 3, 4 and 5) designs.

Study 1 examines when children from grades 1 to 4 (6- to 9-year-olds; N = 805) can take advantage of morphological information that is made available to them, implicitly, through morphological priming.

The primes are base forms that share the same stem with the targets and contain well articulated, stressed vowels. The target words and pseudo-words are derived forms that contain non-stressed schwa vowels. Although differently pronounced the latter vowels are spelled consistently with those in the stems of the base forms.

Primes were either oral or oral plus written. Priming effects were assessed by comparison with a non-primed condition.

No priming effects were detected in 6- and 7-year-old children. Both priming conditions produced a significantly higher level of correct spelling in children 8 and 9 years of age. Oral plus written primes allowed older children to use morphological spellings in both words and pseudo-words. These results suggest that older children can use implicit morphological information to spell schwa vowels morphologically.

Study 2 examined the concurrent relations between morphological awareness and morphologically based spellings. Two issues were considered: consistency in the spelling of stems in base and derived (or pseudo-derived) forms and discrimination in the spelling of words and pseudo-words ending in homophone suffixes. Children from grades 1 to 3 (6 to 8-year-olds; N= 184) participated in the study.

It was found that there was a significant relation between morphological awareness and consistency in the spelling of stems in Base – Pseudo-derived stimuli, after controlling for differences in grade and IQ. Mixed results were found for the spelling of homophone suffixes. The only significant prediction obtained was between morphological awareness and discrimination in the spelling of the words ending in the homophone suffixes ‘-esa’/ ‘-eza’.

In Study 3, the relation between morphological awareness and consistency in the spelling of stems is analysed, longitudinally. Children from grades 1 to 4 (6- to 9-year-olds; N = 184) were assessed in three sessions (A, B and C) each separated by six months.

The results showed that some of the measures of morphological awareness could predict consistency in the spelling of stems over periods of six and of twelve months, after controlling for shared variance with Grade and IQ. This is indicative of a strong link between morphological awareness and consistency in the spelling of stems.

In study 4, the relation between morphological awareness and discrimination in the spelling of words and pseudo-words ending in the homophone suffixes ‘-esa’/ ‘-eza’ is analysed. The suffix ‘-esa’ forms nouns that indicate origin or provenance. The homophone ‘-eza’ forms abstract nouns. The participants and design were the same as in the previous study.

It was found that the younger children tended to use one spelling for the two suffixes. Then, when alternative spellings were used, their assignment was unsystematic. Systematic assignment was rare even in the older children.

Some measures of morphological awareness in session B, accounted for unique variance in the discrimination scores measured in session C, after controlling for differences explained by grade and IQ.

In study 5, the relation between morphological awareness and discrimination in the spelling of words and pseudo-words ending in the homophone suffixes ‘-ice’/ ‘-isse’ is analysed. The suffix ‘-ice’ forms abstract nouns. The homophone ‘-isse’ is used in the subjunctive of some verbs. The participants and design were the same as before.

Correct assignment of suffixes followed the same pattern of spelling phases as described in the previous study. Significant predictions were found between sessions A and B, B and C

and A and C. Some of the morphological awareness measures strongly predicted discrimination scores, after controlling for the effects of grade and IQ.

Study 6 examines the spelling of older children (Grades 5, 7 and 9) and adults (student-teachers and in-service-teachers (N total = 107). The aim was to find out when consistency in the spelling of stems and discrimination of homophone suffixes were eventually achieved and whether the adult participants were aware of the morphological rules that make discrimination predictable.

Consistency in the spelling of stems was only systematic in grade nine. Discrimination of the homophone suffixes ‘-esa’/ ‘-eza’ was not completely systematic after sixteen years of instruction (student teachers). Discrimination of words ending in the homophone suffixes ‘-ice’/ ‘-isse’ was systematic by student teachers. Discrimination in the spelling of pseudo-words was not achieved. Spelling justifications were asked from teachers. These revealed that the knowledge of morphological rules was scarce, incomplete or absent.

This thesis provides first evidence that older children can use morphological information that is provided, implicitly, through priming. It also shows that achieving consistency in the spelling of morphologically related stems is a long process. Systematic discrimination of homophone suffixes is even harder. However, morphological awareness was generally found to contribute strongly to the spelling, and to predict spelling outcomes, even after stringent controls for grade and IQ.

Further research is necessary to examine how children develop morphologically based spellings that cannot be anchored first, in a stable phonological matrix.

These results also suggest that instruction with a strong morphological rationale might significantly enhance spelling development.

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Chapter 1

Introduction

1.1 - Aim of the thesis

The aim of this thesis is to examine the relation between morphological awareness and spelling, in Portuguese (European Variant).

Morphemes are the minimal units of meaning, the building blocks in the processes of word formation.

Morphological awareness is a metalinguistic ability that can be conceptualised both at an implicit and at an explicit level. The first source of implicit morphological awareness is oral language. As children's experiences with language and later with reading and spelling improve so is the likelihood of getting more proficient at reasoning, explicitly, about how specific meanings are conveyed by different morphemes, and how linguistic stimuli with shared morphemes relate to each other.

The morphological awareness measures that were adapted for the studies in this thesis assess to what extent children can move from their implicit awareness of morphology to a progressively more explicit awareness of morphemes.

1.2 – When the spelling is determined by morphology

Portuguese orthography is mostly transparent, with a direct correspondence between phonemes and graphemes. However, there are contexts in which there is a conflict between phonology and morphology. This is related in part to the abundance and complexity of the phonological structure of vowels and diphthongs, either oral or nasal (Cuesta e Luz, 1971). Another source of conflict is the spelling of homophone suffixes that take different

spellings according to their grammatical function (Nunes Carraher, 1985; Cunha & Cintra, 1997).

The spelling issues researched in this thesis form part of clearly identified contexts where spelling requires morphology but where no research exists for the European Variant of Portuguese.

According to Bryant, Nunes & Aidinis (1999) there are three situations in which the spelling is determined by morphology. The studies in this thesis refer to the first two of those situations.

1 - When there are conventional spellings for morphemes that flout letter-sound correspondence rules

The spelling of morphemes is not, necessarily, representing the sounds in the pronunciation in this situation.

Let us start with some examples from English and Portuguese.

If we consider ‘hired’ and ‘heard’, they have the same ending /d/ pronunciation. This /d/ ending, however, is spelled as ‘-ed’ in the first verb, and as ‘-d’ in the second. The reason is that regular and irregular verbs have their morphological status marked in the spelling. Regular verbs, those that keep the stem’s pronunciation in the present and in the past unchanged, have this marked by a specific morpheme ‘-ed’, in the past. Irregular verbs, those that change the stem’s pronunciation in the present and in the past, have not this morphological mark and, therefore, are spelled phonetically (Nunes, et al., 1997 a, b).

As a second example, let us consider the words ‘magic’ and ‘magician’. In these words one has a ‘c’ to represent a /k/ and the other to represent a /ʃ/ sound, in the base and in the derived form. The spelling of the stem in the derived form does not change because that is the way to represent the morphology of related words.

Similarly, in European Portuguese, much of the burden put on spellers is related to the spelling of stems in derived words in which the spelling flouts letter-sound correspondence rules. Usually, the spelling of these stems in base words is phonologically transparent, but becomes phonologically opaque when a suffix is added.

In this language, the stress in base words falls on a vowel that is well articulated and clearly pronounced. When a suffix is added, the derived word usually has its stress moved to the suffix, and the pronunciation of the previous vowel changed or even suppressed.

Let us consider some examples.

Firstly, the base and derived words ‘negócio’ (business) and ‘negociante’ (business person) - for clarity, the place of the stress is underlined and the vowel in bold represents the place of the stress in the base word and the transformed vowel in the derived word, respectively.

In this example the ‘ó’ is pronounced as /ɔ/ in the base and as /w/ in the derived form. If the child follows a phonological approach, the latter word would be spelled as ‘neguciante’. Keeping the stem ‘negoc-’ constant, is a condition to spell the derived word accurately. In a second example, if we consider the words ‘martelo’ (the hammer) and ‘martelar’ (to hammer) the stressed /ɛ/ in the former word is suppressed and therefore unpronounced (/ø/), in the derived form. If the child uses a phonological approach, not taking the stem ‘martel-’ into consideration, the derived word would also be wrongly spelled as ‘martlar’.

Knowing how this ability to keep stems consistent develops and what enhances children to use this knowledge has not been researched in Portuguese (European Variant). The development of this ability is extremely important because processes of vowel reduction, vowel modification, or even vowel suppression occur in the pronunciation of the vast majority of suffixed words in European Portuguese.

2 - When there is more than one possible spelling for the same sound.

The second situation in which the spelling is determined by morphology (Bryant et al. 1999) is related to the existence of different spellings for the same sound. In English, one can not spell 'fox' as 'focks' although 'cks' is the correct spelling for the same ending sound in 'socks'. This is because there is a morphological rule for words ending in /ks/. If a word is a noun or an adjective in the singular, as in 'fox' it will end in '-x' (occasionally, this ending can be '-xe' as in 'axe'). If it is a plural noun, as in 'socks', or a verb in the third person singular present tense, as in 'licks' or 'picks', the ending is '-cks' (Bryant et al., 1999; Bryant, 2002).

Similarly, in Portuguese, the same sound cluster is spelled in two different ways in homophone suffixes. Because of this, the spelling of these morphemes is a source of conflict for children. In this thesis, two pairs of homophone suffixes will be examined.

The first is an ending sequence sounding as /eza/ that may be spelled as '-esa' or as '-eza'.

The former spelling, '-esa', is the derivational suffix '-ês' in its feminine inflection. In words such 'portuguesa', 'camponesa', 'burguesa', 'freguesa' (meaning, Portuguese, a rural worker, bourgeois and customer, respectively, all in the feminine) this adds a meaning of belonging to, or either ethnical or social provenance. There are a few exceptions for the feminine form of noble titles such as 'princesa' and 'duquesa' (meaning,

princess and duchess). The latter spelling ‘-eza’, is a derivational morpheme that forms abstract nouns such as ‘beleza’, ‘tristeza’, and ‘riqueza’ (meaning beauty, sadness, and richness, respectively).

The second case is an ending sequence sounding /is/ that can be spelled as ‘-ice’ or as ‘-isse’. The former spelling is a derivational morpheme that forms abstract nouns (‘tolice’, meaning, foolishness). The latter is an inflectional morpheme for the subjunctive of some verbs (‘se eu fugisse’, meaning, if I ran away).

These homophone suffixes have had their rules identified and some cross-sectional research carried out in the Brazilian Variant of Portuguese (Nunes, 1992; Nunes Carraher, 1985; Da Mota, 1995). However, no longitudinal studies have examined how their spelling develops and whether morphological awareness is likely to be causally related to spelling improvement. This will be the object of this thesis.

3 – When silent morphemes have to be spelled.

The last spelling situation that is determined by morphology (Bryant et al. 1999) involves the spelling of silent morphemes. Examples of this are the spelling of the apostrophe to denote possession, in English (Bryant, Nunes & Levine, 1997) and the spelling of silent plural markers in nouns, adjectives and verbs, in French (Fayol et al., 1999). This issue is not investigated in this thesis because it does not appear to be relevant in Portuguese.

Research in this area, however, also contributes with important evidence for the use of models of spelling development. This is why close attention will be given to these studies in the literature review.

1.3 - Research Strategy

In order to research the above issues a combination of cross-sectional and longitudinal methods will be used.

There are sound theoretical advantages of combining different research methods (Bradley & Bryant, 1983). Finding complementary evidence for the role of morphology in studies using different designs will strengthen the claim for causal relations between morphology and spelling.

The first cross-sectional study is descriptive of children's spelling performance on phonologically changed vowels, in the stems of derived forms. Different conditions of morphological priming are manipulated in order to examine whether priming maximises the likelihood of using morphology.

Several researchers (Kempley & Morton, 1982; Emmorey, 1989; Laudanna et al., 1992; Laudanna et al., 1989; Stolz & Feldman, 1995) have found that for adults, morphological priming facilitates access to the morphemic structure of target words. The use of morphological priming in a study of children's spelling examines whether a similar facilitation occurs when children spell morphologically related, non-transparent, stems.

According to developmental research (Nunes, Bryant and Bindman, 1997 a, b), morphological awareness is causally related to the development of spelling, when the spelling requires morphology. The second group of studies in this thesis examines how morphological awareness and morphological spellings improve and whether concurrent and predictive relations can be identified between the two.

Words and pseudo-words will be used in all studies. Pseudo-words control for the influence of previous lexical knowledge.

Low-frequency words will also be used in all studies. Frequency is examined through a Corpus of Word Frequency in Portuguese, developed by the researcher for this thesis. This Corpus derived from frequency analysis of words, printed in school reading books, used in Portuguese schools, from grades one to four. The total number of words entered for analysis was 85,310. After aggregating the frequencies for identical words, a Corpus of 7,816 different words, classified for frequency, was formed. Frequency is related to spelling. Studies in different languages have found that high-frequency words are better spelled than low-frequency words (Ellis, 1985; Aidinis, 1998; Dominguez & Cueto, 1992; Pinheiro, 1995). Thus, the use of low-frequency words places a higher level of demand on the speller and facilitates the observation of spelling development.

The study of causal relations requires control for ‘third’ factors such as general intelligence (IQ). Another source of shared variance is instruction itself. One cannot be sure that a relation between morphological awareness and spelling is unique unless an appropriate control for the effects of instruction is achieved. Because of this, IQ and Grade differences will be controlled first in the study of predictive relations between morphological awareness and spelling.

1.4 - The organisation of the thesis

The following chapter (Chapter 2) reviews and examines two main issues in the literature. The first, how morphemes are accessed, takes into consideration the theoretical and empirical contributions from morphological priming studies with adults. The second, how children develop the ability to use morphology in contexts where phonology is not enough and how that is related to morphological awareness. Close attention will be paid to studies

that propose developmental models and to the extent to which these models have received support in cross-linguistic research.

The third chapter reports a cross-sectional study on the effects of morphological priming on the spelling of stems in derived words. It examines whether the use of transparent stem-primers facilitates access to the constituent morphemes in the spelling of morphologically related, non-transparent, stem-targets. This study aims to establish whether it is reasonable to expect that 6- to 9-year-old children can be influenced by morphological information, provided under the form of priming.

The following hypotheses will be tested: morphological priming can be suitably used with children; different forms of priming will have differential effects; morphological priming will facilitate the access to stem morphemes in the stems of derived words and pseudo-words.

In the fourth chapter, a cross-sectional study is reported that examines how morphological awareness is specifically related to the abilities to spell morphologically related stems consistently and to discriminate the spelling of the homophone suffixes ‘-eza’ / ‘-esa’ and ‘-ice’ / ‘-isse’.

The focus in this chapter will be the concurrent relations in the first session of a longitudinal study. This is motivated by the need to examine whether measures of morphological awareness, as well as the spelling measures that were developed for the study, are reliable and assess children’s development accurately. The main aim is to examine whether morphological awareness plays a specific role in the development of accuracy in morphologically determined spellings.

The following hypotheses will be tested: morphological awareness and knowledge about morphologically determined spellings will progress with age and grade; morphological

awareness makes a specific and significant contribution to the prediction of spelling improvement, that can not be explained by ‘third’ factors, such as differences in level of school instruction (Grade) and intelligence (IQ).

In the fifth chapter, the results for the three sessions of the longitudinal study will be considered, focusing only on the development of consistency in the spelling of stems. The aim is to analyse longitudinal predictions, i.e., the hypothesis that morphological awareness measured in earlier sessions predicts consistency in the spelling of stems in later sessions. If such prediction is found, this will converge with existing cross-linguistic evidence that morphological awareness could be causally related to improvement in the spelling of morphologically determined words.

In the sixth chapter, the results for the three sessions of the longitudinal study will be considered, focusing on whether morphological awareness predicts discrimination in the spelling of homophone suffixes. The spelling of the homophone suffixes ‘-esa’ / ‘-eza’ will be the focus in this chapter. Children’s scores are examined quantitatively, with two methods. Firstly, the scores are analysed as categories, or phases of spelling, according to a phase model (Nunes et al., 1997 a; Bryant, 2002). Secondly, the scores are analysed as a continuous measure of spelling discrimination. Finally, predictive relations will be analysed, by examining whether morphological awareness measures taken earlier in the study, predict level of discrimination in the spelling of these homophone suffixes, in later sessions.

In the seventh chapter, the results for the three sessions of the longitudinal study will be considered, now in relation to the spelling of the homophone suffixes ‘-ice’ / ‘-isse’. The study will also look at phases of spelling, at discrimination as a continuous improvement, and at longitudinal predictions from morphological awareness to discrimination in the spelling of these homophone suffixes.

In the eighth chapter, a cross sectional study will examine when systematic consistency in the spelling of stems and discrimination in the spelling of homophone suffixes is eventually achieved. The spelling of older children and teachers will be analysed. Teachers will be asked for justifications for their spelling choices, in order to further understand whether morphological rules are known and used in the spelling.

In the final chapter, the major findings will be summarised and the conclusions discussed in relation to current theories. The relevance of morphological awareness in explaining children's spelling development will be stressed. Limitations arising from the studies will be presented. Finally, further research developments, and both theoretical and educational implications will be proposed.

Chapter 2

Accessing morphemes

and representing them in the spelling

The aim of this chapter is to review studies on how the morphological structure of linguistic stimuli is accessed, and the developmental processes followed to represent morphemes in the spelling.

To achieve this aim, a bridge between two different theoretical approaches, that have largely been separated, is attempted. Morphological priming studies are reviewed first. One of the strongest claims coming from these studies is that words are represented in the lexicon through access to their constituent morphemes and that this access is automatic and highly specific. Studies on the development of morphology in the spelling are reviewed later. These studies attempt to map situations in which morphological strategies are required and identify the developmental trends and factors underlying such development.

This review is divided into two sections, each examining one of the above approaches.

2.1 – Morphological priming and access to morphemes

The aim of this section is to provide evidence that linguistic stimuli are accessed via their morphological structure. This will be done by reviewing studies that have used morphological priming to examine the effects of stimuli that are presented first (the primes) in facilitating access to morphologically related stimuli (the targets) by adults. The main claim of these studies is that, when primes and targets are morphologically related, the access to the target is facilitated. This is because the morphological structure of the

prime facilitates the recognition and activation of the morphological structure of the target. This influence occurs without the participants' explicit awareness, and is independent from phonological, semantic, orthographic and frequency effects.

Priming studies usually examine lexical decisions (i.e., deciding whether the target is a word or a non-word) and speed of naming or speed of recognition (i.e., how long does it take to name or recognise the target).

Primes and targets are usually provided visually or auditorily. Visual primes are presented for a very short period, below the threshold of visibility and auditory primes are briefly presented too. Sometimes primes or targets can be presented masked, e.g., one of their constituent graphemes or phonemes is covered by a script mask or with a noise mask. The time between the presentation of the prime and target, the stimulus onset asynchrony (SOA), can be manipulated, as well as the number of intervening items between both stimuli. These procedures are thought to enhance independence from explicit awareness, thus strengthening forms of automatic processing. Reaction times, measured in milliseconds, assess the speed of processing, i.e., how long it takes, from the onset of the target, to reach a lexical decision, to name, recognise or decide whether the target is a word or a pseudo-word. Error rates, i.e., how frequently a target has been incorrectly identified, are also used as a dependent variable.

In an alternative procedure, primes are delivered in a pre-test phase, also named as pre-training phase. Here, the participants listen to or see word stimuli, and are asked to perform some task irrelevant to the underlying morphological rationale in them (e.g., rate the primes in a scale of imagery). Later they are tested with the experimental stimuli (the targets). Some of the targets had been primed in the pre-test phase.

There are two main research themes. The first is whether word stimuli are accessed in the lexicon through their morphological structure or, alternatively, as separate whole-word entities. The second is whether morphological priming effects are specific or rather artefacts of semantic, phonological and orthographic similarities, or even a by-product of frequency relations between primes and targets. These two themes are intertwined, and usually all studies reporting morphological priming effects attempt to control for the possibility of artefacts.

Morphological priming effects may be related to the specific levels of transparency or shallowness in different languages. Although this is not a major issue in the findings so far, Studies conducted in the English, Italian and French languages are reviewed. These are languages with a considerable common Latin / Greek matrix, as is the case of Portuguese. Priming studies have also been conducted on other languages but will not be reviewed here.

My end objective of this section is to suggest that the main findings from morphological priming studies with adults can provide theoretical support for examining how children access morphology when spelling words that are not transparent.

As far as one knows, there is no research extending the basic conclusions of morphological priming studies with adults, to examine facilitation effects of morphological priming on children's spelling processes.

2.1.1 – Morphological Priming studies

The precursors of morphological priming studies date back to the work of Morton (1969) and collaborators (Murrell & Morton, 1974; Kempley & Morton, 1982).

Murrell & Morton's work (1974), although still in the context of a study of memory processes, used a technique that was already quite coincident with morphological priming. The participants of their study underwent a pre-training session, before the test session. The major difference with priming designs was that explicit instruction was given to participants so that they attempted to memorise a list of words in the pre-training phase, as some of them could appear in a subsequent testing phase. The rationale of the study, however, was already well within the current research themes of morphological priming: to examine whether *'the unit concerned in recognition facilitation is a word as a visual-phonetic pattern, or a form bound to a specific semantic unit, i.e., a morpheme'* (p. 964).

The participants in their study (N = 16) first underwent a practice phase, in which a baseline flash duration was found for each subject. Secondly, they were asked to memorise (pre-training) a list of 12 words (primes) that belonged to three conditions:

- 1 – were a root morpheme (e.g., car);
- 2 – were an inflection or derivation of the same root morpheme (e.g., cars);
- 3 – contained the same visual-phonetic pattern (card).

Thirdly, they were presented with the experimental words (targets), and asked to say them aloud as soon as they could recognise them. These were flashed in a tachistoscope, at or slightly above each individual's threshold of visibility. Words that had not been learned in the pre-training phase served as control.

They found that there was an overall effect of pre-training on word recognition because:

- 1 – Target words that were identical to the primes were recognised significantly faster than the control words (Condition 1);

3 - Morphologically related words were recognised significantly faster than the control words (Condition 2).

4 – Visually similar words were not recognised quicker than control words (Condition 3).

They concluded that the pre-training was significantly effective in facilitating the recognition of words that are morphemically identical (for example 'car – car') and morphologically related (as in, 'car – cars'). This significant facilitation effect was due to a morphemic activation by the prime when the target is processed. Target words (e.g., card) that are only visually and acoustically similar to the primes (e.g., car), do not have their recognition facilitated because different morphemes are accessed in the prime and in the target.

Kempley and Morton (1982) examined whether morphological priming facilitated access to morphologically related targets, and whether such facilitation was not an artefact of semantic similarity.

They raised the point that the results in Murrell & Morton's study (1974) could be an effect of semantic similarity because some of the words learned in the pre-training phase were regularly related to the experimental words. In order to control for semantic similarity, Kempley and Morton added to a set of regularly, morphologically related, prime / targets (e.g., doubt – doubted), another set of irregularly, morphologically related, pairs (e.g., looses - lost).

They hypothesised that there would be facilitation effects in the morphologically related conditions. However, if the effects were semantic, the same amount of facilitation would occur for regularly and irregularly related word pairs. If the effects were independent of

semantic similarity then a different amount of facilitation should be expected from regularly related, when compared to irregularly related pairs. In the former, the same base morpheme is accessed in the prime and target (as in, doubt – doubted) and thus the target should be processed more rapidly. In the latter, because a different base morpheme is accessed in the prime (looses) and in the target (lost), the processing of the target should take longer.

The participants were 32 adults. The stimuli contained regularly (R) and irregularly related (IR) prime / targets in four priming conditions:

- 1) Identical prime / target (e.g., (R): talk – talk; (IR): lost – lost);
- 2) Morphologically related prime / targets (e.g., (R): talked – talk; (IR): loses – lost);
- 3) Acoustically similar prime / targets (e.g., (R): cork – talk; (IR): cost – lost);
- 4) Control condition (no prime).

The participants underwent a training phase first and a test phase later. In the training phase, the participants heard a list of words twice, and rated each word for imagery. This procedure was aimed to withdraw explicit information about the role of the primes. In the test phase, they were asked to carry out auditory word recognition of target words masked with noise. More specifically, they heard the target word in which one of the phonemes was superimposed with a noise mask, and were given 8 seconds to write it down.

Proportion of correct spelling of the target word was the dependent variable.

They found that experience in the pre-test phase with a regularly related word, such as 'doubt', facilitated the recognition of morphologically related targets, such as 'doubted'. On the other hand, prior experience with an irregularly inflected word, such as 'looses', did not facilitate the recognition of 'lost'. Regularly related targets were facilitated only by identical and by morphologically related primes. Irregularly related targets were only facilitated by identical primes.

They concluded that the lack of facilitation with irregular relationships rules out any explanation of morphemic priming based on notions of semantic facilitation. Thus, facilitation for regularly related prime / target words is not an artefact of semantic facilitation.

This study provides additional evidence to what had been previously found by Murrell & Morton (1974), that primes enhance the access to targets in the morphologically related conditions. The two studies also provide evidence that such effects are not based on visual (orthographic) or phonetic (phonological) similarity (Murrell & Morton, 1974), or semantic relation (Kempley & Morton, 1982). However, it must be taken into account that there is a methodological shift in the two studies. In the first, explicit instruction about the primes typified a study on memory processes. In the second, rating the primes for imagery assured that participants did not gain explicit awareness and therefore lexical access processes were being controlled. Thus, although these two studies open a trend in research, their findings cannot in essence be collated.

Emorey (1989) conducted three experiments in auditory word recognition manipulating different types of relations between primes and targets. Her aim was to investigate a broader issue related to word representation theories, i.e., to evaluate whether the lexicon is

word-based, morpheme-based, or based on a combination of morpheme and word representations.

Her studies test two main models or theories of word representation:

1 – The morpheme-based theories, that claim that both root and affixes have lexical entries and that lexical rules may apply to morphemes as well as to words (Caramazza, et al., 1985)

2 – The word-based theories, that propose that affixes do not have lexical entries and lexical rules only apply to words (Buttenworth, 1983).

She also proposes, in accordance to what had been suggested by Aronoff (1976), that the definition of morpheme should be adjusted from the traditional minimal unit of meaning in order to include morphemes which have no constant meaning (for example, ‘-mit’, as in submit and permit). According to this view, “*elements that share a phonological operation (...) a phonetic string which can be connected arbitrarily to a linguistic entity outside that string – either to a constant meaning or to a morphophonemic rule*” (p. 74), should be included in a wider definition of morpheme.

Bearing this definition in mind, the aim of her first experiment was to examine the nature of morphological representations and to investigate whether morphological relations among words are represented differently from phonological relations.

Undergraduates (N= 40) were required to make lexical decisions for prime / target pairs.

The stimuli contained four priming conditions:

1 – morphologically related prime / targets, sharing a bound stem (e.g., submit – permit);

2 – morphologically unrelated prime / targets (e.g., abuse / permit);

3 – phonologically related prime / targets (e.g., saloon – balloon);

4 – phonologically unrelated prime / targets (e.g., baton / saloon).

There were two lists with 128 pairs of prime / target tape-recorded stimuli. Half of the subjects heard the first list; the other half heard the second. The first list contained 16 morphologically related pairs (e.g., submit / permit), plus 16 phonologically unrelated pairs (e.g., baton / saloon), plus 32 filler word pairs and 32 filler word - non-word pairs. The second list contained 16 morphologically unrelated pairs (e.g., abuse / permit), plus 16 phonologically related pairs (e.g., balloon / saloon), plus the fillers. Primes were always words. Targets could be either words or non-words. The participants were requested to only make lexical decisions about the second item in the pair. Reaction times measured the time elapsed from a non-audible tone marking the onset of the target to the pressing of a key with a 'yes' (a word) or 'no' (a pseudo-word) answer. Primes and targets were separated by 50 ms (SOA).

She found that lexical decisions were faster when targets were preceded by a morphologically related prime that shared a bound stem (priming condition 1). Conversely, participants took longer to respond to morphologically unrelated prime / targets (priming condition 2). Non-significant effects of prime type (related vs. unrelated) were observed when the word pairs were only phonologically related and did not share a root morpheme with the targets.

She concluded that morphological relations are represented in the lexicon even when those relations are purely structural (as, for example, the bound stem '-mit'). On the other hand, morphological relations are not defined solely within the semantic component (there is no

semantic relation between 'submit' and 'permit'), and morphological relations may be defined by morphophonemic rules. This suggests that the unit of representation is the morpheme rather than the word, which supports the 'morpheme-based model'.

In a second experiment the aim was to examine whether morpheme representations are not specific of bound stems but can also be found for bound suffix morphemes (for example, the suffix '-er' as in *drummer* – *thinker*).

Here, the two previous models lead to two different predictions. If the morpheme-based model is correct, priming effects should be found for suffixes. If the word-based model is correct, affixes do not have separate lexical entries and, therefore, no priming should occur.

The participants were undergraduates (N=20). Each participant heard 216 prime / target stimulus pairs: 54 related word pairs, 54 unrelated word pairs and 108 word – non-word pairs. The participants made lexical decisions for the targets. The procedure was the same as in the previous experiment.

The stimuli contained six priming conditions. These were formed by the inter-relation of two prime types (morphologically related and unrelated) and three target types (derivational, inflectional and phonological control). In the morphologically related condition, the primes shared either a derivational suffix (e.g., '-ness', as in *blackness* – *shortness*) or an inflectional suffix (e.g., '-ing', as in *smiling* – *breaking*) with the targets. In the control condition primes and targets shared final segments (e.g., '-go', as in *tango* – *cargo*).

Significant overall effects of priming were found. When the related and unrelated conditions were compared, significant priming effects were found for pairs that shared a

derivational suffix (for example, the suffix ‘-ness’, as in, blackness – shortness). No significant priming effects were found for pairs that shared an inflectional suffix (for example, the suffix ‘-ing’, as in smiling – breaking). However, there were also significant priming effects for pairs that shared final segments (for example, the final segment ‘-go’, as in, tango – cargo).

Because of these mixed findings, i.e., priming effects for both derivational suffixes and final segments, she concluded that the former effects are certainly explained by a phonological relation between prime and target. According to Emmorey (1989), this study appears to support a word-based model in which suffixes have no separate lexical entries.

A new hypothesis was proposed that priming effects did not appear for inflected morphemes because not all words shared a final syllable. Priming due to shared syllables might be more robust than priming due to shared segments alone.

In order to examine this hypothesis a third experiment was conducted.

The participants were undergraduates (N=20). As in the previous experiments they made lexical decisions for word pairs that were arranged in six priming conditions. These were defined by morphological relatedness (related (R) and unrelated (UR)) and the type of final syllable shared. There were:

- 1) inflectional prime / target pairs with shared syllable (e.g., (R) dumping – shaping; (UR) whistle – shaping);
- 2) inflectional prime / target with no shared syllable (e.g., (R) smiling – breaking; (UR) hurry – breaking);

- 3) phonological prime / target with shared syllable (e.g., (R) tango – cargo; (UR) fable – cargo).

The total number of stimulus pairs was 216, including words and non-words and the procedure was similar to experiments 1 and 2.

The results confirmed the hypothesis that sharing a final syllable made a significant difference in the amount of priming that was found. Comparing the related and unrelated conditions it was found that reaction times were significantly faster in the morphological related condition for inflectional targets (e.g., dumping – shaping) and for phonological targets (e.g., tango – cargo) with shared final syllables. No significant priming effects were found for inflected targets that did not share final syllables (e.g., smiling – breaking).

According to the researcher, these results reinforce the conclusions drawn from experiment 2, that suffixes do not have independent representations. Thus, a morpheme-based model in which affixes have lexical entries is not supported.

Emorey (1989) draws three general conclusions from these experiments:

1. Morphological relations are represented in the lexicon even when those relations are purely structural (Exp.1); this can not be attributed to a semantic or phonologic relation and therefore, favours a morpheme-based model.
2. Affixes do not provide entries for accessing lexical representations. No evidence of priming for derivational suffixes (Exp.2) and for inflectional suffixes that are not in a syllable context (Exp. 3). This favours a word-based model in which suffixes are not independent of syllabic representation processes.

These experiments (Emmorey, 1989) widen morphological priming effects found for base morphemes (Kempley & Morton, 1982) to encompass non-meaningful, structural, bound morphemes. Doubts were raised, however, that suffixes can be primed and that any effects are not explained by its syllabic representation.

It is unclear whether the conclusions in the third experiment would suggest that the findings in the first experiment be re-examined. In fact, if priming effects are due to phonological similarity and sharing final syllables (Exp. 3), reaction times in Exp. 1 for the bound-stem morphological related condition (e.g., submit – permit) should not differ from the phonological control condition (balloon – saloon). In both conditions there is a shared final syllable, although the bound stem ‘-mit’ is not a suffix. Evidence for effects due to shared syllables are mixed. On the one hand, effects were found for the same final syllable (e.g., dumping – shaping) in Experiment 3; on the other hand, no effects were found for the same stimuli configuration (e.g., balloon – saloon) in Experiment 1.

Could these mixed results relate to design problems? It would be of interest to have a last experiment also controlling for the positive effects of Exp. 1 with four conditions:

- 1) Shared final syllable as a stem bound morpheme (e.g., submit – permit);
- 2) Shared final syllable as an inflectional suffix (e.g., dumping – shaping);
- 3) Shared final syllable as a derivational suffix (e.g., shortness - blackness);
- 4) Shared final syllable as a segment (e.g., tango – cargo).

If the problem is just the sharing of a final syllable, then no differences should be found across conditions. If significant differences were again found for 1), then bound

morphemes have a specific representation in the lexicon. This would re-confirm that findings of Exp. 1 were not an artefact of phonology.

Forster & Azuma (2000) returned to the issue of knowing whether priming effects can be obtained with prefixed words that share the same bound stem (e.g. submit – permit). Their general aim was to test whether morphological structure plays a role during the initial perception of a word.

They report three experiments. In the first they tested whether prefixed words sharing the same bound stem (e.g., *survive* – *revive*, *inhibit* – *prohibit*) show priming effects in a masked priming paradigm.

Undergraduate students (N = 54) participated in the first experiment. Two equivalent lists of stimuli were constructed, each one presented to half of the subjects. The stimuli contained three priming conditions, with 24 pairs of words in each condition:

- 1 – both prime and target had bound stems (e.g., *survive* – *revive*);
- 2 – both prime and target had morphologically related free stems (e.g., *happy* – *unhappy*);
- 3 – prime and target were identical (e.g., *gallery* – *gallery*).

There were two types of primes: morphologically related and unrelated. Half of the participants performed the task in the related, the other half in the unrelated condition.

There were 72 experimental word prime-target pairs and other 72 non-word distractor pairs.

The items were presented on a computer screen with the following format: forward mask (500 ms) – prime (50 ms) – target (500 ms). The participants were requested to make a lexical decision and received feedback for speed and accuracy of response.

Foster & Azuma (2000) found that reaction times in each of the three conditions of priming and overall were significantly faster in the related than in the unrelated condition. However, in the related condition, the amount of priming was not different amongst the three conditions.

They concluded that morphologically related bound stems, free stems, and identity stems were more effective than unrelated stems in facilitating lexical decisions.

In a second experiment they examined whether the priming observed for morphologically related bound stems was any greater than it would be expected on the basis of orthographic overlap alone.

The experimental conditions were as in the previous experiment with the exception that the identity condition was substituted by an orthographic control condition that had the same orthographic overlap (e.g., shallow - follow) as the bound stem condition (e.g., survive – revive).

No significant differences between the three conditions were found.

Accordingly, they concluded that orthographic overlap might explain priming effects.

However, they claim that *'the fact that the same amount of priming is obtained for morphologically related pairs and for orthographic control pairs does not necessarily*

mean that there is no morphological effect. A more appropriate conclusion would be that it is impossible to tell whether there is any morphological effect' (p. 550).

In order to establish whether priming for bound stems was due to morphological relations or to orthographic overlap (a form-priming effect), a new experiment was designed in order to eliminate form-priming effects. This was attempted by increasing the prime duration to a limit that had been found to eliminate form priming effects in the masked priming paradigm (Forster & Veres, 1998).

In this new experiment the same word targets were used but the prime duration was increased to 68 ms.

It was found that reaction times for prefixed words with bound stems (e.g., survive – revive) and free stems (e.g., happy – unhappy) were significantly lower in the morphologically related condition when compared to the unrelated condition. Orthographic controls (e.g., shallow – follow) were not spelled significantly faster in the related when compared to the unrelated condition.

From this experiment they concluded that the maintenance of strong priming for the bound stems under conditions that eliminate form priming is strong evidence for a genuine morphological effect.

However, additional analysis suggested that priming was dependent on stem productivity when combined with a prefix. Stems that were highly productive (e.g., *'-rupt'*, that can form *disrupt*, *erupt*, *abrupt*, *interrupt*, *corrupt*) show higher priming than less productive stems (e.g., *'-vive'*, that can only form *revive* and *survive*).

With all the experiments taken together, they concluded that morphological and orthographic priming effects can co-occur, but do not summate. Morphological priming effects with prefixed words with bound stems or with prefixed words with free stems are genuine morphological effects and differ from orthographic overlap. Such priming, however, depends on stem productivity.

Raveh & Rueckl, (2000) studied whether English inflections and derivations differ in the degree to which they prime the base forms.

Four experiments are reported. In the first, American adults performed a study phase first, in which they were asked to classify base, inflected, derived and filler words. This was followed by a filler task in which the participants had to complete a word when given the two first letters and instruction about how short or long the word was. The experimental task was a test fragment completion task in which respondents had to type a word that was adequate for that fragment. The stimuli contained four priming conditions:

1 – Primes and targets were identical (e.g., bake - _ake)

2 – Inflection priming (e.g., baked - _ake)

3 - Derivation priming (e.g., baker - _ake)

4 – Unprimed

It was found that the proportion of correct target completion was significantly higher in the first three priming conditions when compared with the unprimed condition. Identity priming was significantly more effective than inflection and derivation priming. There were no differences between inflection and derivational priming.

This evidence led them to conclude that the priming facilitation for inflections and derivations are not due to different processes of representation.

They then attempted to examine whether these results could be replicated using a different procedure. The design and the stimuli were the same as before except that an equivalent number of pseudo-words were included. This time, participants ($N = 75$) performed a lexical decision task.

They also found that the mean reaction time was significantly lower overall and in each of the three priming conditions, when compared with the unprimed condition. Reaction times for identity priming were significantly faster than for derivation priming but did not differ from inflectional priming. There were no differences between inflection and derivational priming.

The results from this experiment confirmed the previous conclusions that there is no evidence supporting the claim that inflections and derivations are represented or processed in fundamentally different ways.

Experiments 3 and 4 were replications of experiments 1 and 2 with a different set of stimuli controlled for lexical ambiguity and for target frequency. To control for lexical ambiguity they excluded some words that could be interpreted as nouns or as verbs and thus, it was impossible to know which of them was accessed. In order to control for target frequency, targets with a lower frequency than the primes were used. The use of lower frequency targets should enhance the sensitivity of morphological priming because frequency has been found inversely related to the magnitude of priming. It has been found that high-frequency primes are not appropriate stimuli. On the contrary, the higher the frequency the lower the priming (Bowers, 2000). Giraudo & Gaigner (2000) also claim

that *“high frequency orthographically related primes tend to produce interference (rather than facilitation) in target word processing”* (p.429).

The same designs as in experiments 1 (fragment completion) and 2 (lexical decision task) were used.

It was found that the proportion of correct target completion and mean reaction times were significantly higher in the three priming conditions when compared with the unprimed condition. Identity priming was significantly more effective than inflection and derivation priming. However, there were no differences between inflection and derivational priming.

The latter two experiments added additional strength to the general conclusion that inflected and derived primes are equally effective in morphological priming and more effective than no priming.

Different languages are differently embodied in morphological structure. The above reported studies were conducted in the English language, a morpho-phonetic, non-transparent, language. It could be that models of access to the morphological structure of words would follow different processes in other alphabetic languages. Some studies conducted in the Italian and French languages are reviewed now.

Studies in Italian, a transparent language, provide crucial information to models of representation of morphology in language processing.

Laudanna, Badecker & Caramazza (1989) examined the plausibility of the claim that lexical representations are morphologically decomposed. They manipulated words with homographic stems that, contrary to what happens in a morphologically related condition, are not morphologically nor semantically related. For example, the Italian words ‘portare’

(to carry) and 'porte' (doors) have the same homographic and homophone stem 'port-', but no shared morphology nor meaning relations.

Their prediction would be that facilitating effects typical of words with the same morphologically related stem should not be found with these homographic unrelated stems. Lexical decisions for homographic stems should be worse in comparison to control pairs of stimuli. For stimuli containing homographic stems, the first lexical (stem) representation to be activated would (partially) inhibit the activation of the other stem, making the double word decision more difficult for these stimuli. Or, alternatively, it could be expected that the activation of homographic stems would be mutually inhibitory. In either case, the effect should be worse performance for homographic stem pairs than for controls.

In order to examine these predictions three experiments were conducted. In all, adults were asked to make lexical decisions about stimuli visually presented on a computer screen.

In the first experiment, a double lexical decision was used in which participants ($N = 20$) had to recognise both prime and targets as a word or non-word. The list of stimuli contained 15 stem homograph word pairs (e.g., *portare* – *porte*, meaning, to carry - doors) and 15 orthographically similar non-homographic stem pairs (*contare* – *corta*, meaning, to count – short). Thirty pairs of semantically related and unrelated words (no examples provided) served as control. Word - non-word pairs and non-word – non-word pairs, generated from the former word stimuli, were also included.

It was found that lexical decisions for homographic pairs were significantly slower than for orthographic similar, non-homograph pairs. The former, were also significantly slower than control pairs.

According to Laudanna et al. (1989), this was due to an inhibitory effect. If word-based models of processing were right, words with homographic but semantically unrelated stems would be accessed as independent entries and should be performed as quickly as non-homograph pairs, where no inhibitory effect was found. This is incompatible with the view that words are represented in the lexicon as whole-word units.

One way to show that orthographic similarity of the stems did not account for the previous results was to compare two conditions of priming with homographs, one replicating the previous findings with morphologically unrelated prime / target stems and the other with morphologically related stems. This was attempted in a second experiment.

The predictions were that homographic unrelated stems (e.g., *portare* – *porte*) should replicate the inhibitory effects previously found but morphologically related homograph stems (e.g., *posto* – *posti*, meaning place – places) should produce facilitation. In effect, while two different stems were to be accessed in the first case, only one stem was required for lexical access in the latter condition. On the other hand, because neither inhibition nor facilitation were artifacts of orthographic similarity, no facilitation should occur with two control conditions. One, with orthographically similar (but non-homograph) pairs (e.g., *contare* – *corta*, meaning to count – short) and the other, with unrelated (non-homograph) stimuli (e.g., *causa* – *ponte*, meaning cause – bridge).

They found that decision times on stem unrelated homographs were significantly slower than on morphologically related pairs. They were also slower than in the control conditions. Morphologically related pairs were responded to significantly faster than orthographically similar and unrelated control pairs. Orthographically similar pairs were no different from unrelated pairs.

This experiment supports the predictions that homographic stems produce inhibition, morphologically related stems produce facilitation, and that neither inhibition nor facilitation are a function of orthographic similarity.

Laudanna, Badecker & Caramazza (1989) raised a new hypothesis that the relative frequency of primes and targets could obscure inhibitory effects. Were this true, high frequency stem primes were expected to succeed in inhibiting low frequency targets but low frequency stem primes should not inhibit high frequency targets. Non-symmetric results should then be an expectable outcome. If, however, the inhibitory effect is solely activated by the homography of the stems and not by their relative frequency, symmetric results should be found.

In order to examine this hypothesis, in a third experiment high frequency and low frequency stem unrelated homographs (either entered as primes or as targets) were compared with high frequency and low frequency unrelated controls.

They found that there was no interaction between frequency and priming. Low frequency stem primes inhibit high frequency homograph stem targets as effectively as high frequency stem primes inhibit their low frequency homograph stem targets.

These results provide very strong support for a morphological decomposition model in lexical processing. In another study (Laudanna, Badecker & Caramazza, 1992) the same researchers suggest that inhibition effects appear when *“the activation of a stem entry interferes with the subsequent attempt to activate the orthographically identical stem entry.* (...) *What makes this an argument for morphological decomposition is that the relevant items are homographs only when their inflectional endings are ignored. (...) Hence, it would appear that the effect must take place at a level of processing (the orthographic*

input lexicon) where lexical forms are represented in terms of their constituent morphemes: stems and inflections” (pp. 333-334).

Laudanna, Cermele & Caramazza (1997) examined how morphological structure affects latencies in naming pseudo-words with full or partial morphological structure.

In a first experiment 21 Italian adults were presented with pseudo-words on a screen and asked to pronounce them as rapidly as possible. The experimental stimuli consisted of pseudo-words with morphologically decomposable structure (such as, ‘dormevo’, formed by a real stem ‘dorm-’ from the verb ‘dormire’ – to sleep – and a real inflectional suffix ‘-evo’ that cannot be used with this type of verb conjugation) and pseudo-words with non-decomposable morphological structure (e.g., ‘decrelo’).

Laudanna et al. (1997) hypothesised that if the pseudo-words are processed through a letter-to-sound approach, then no differences should be expected in naming latencies between decomposable and non-decomposable stimuli. If, however, morphologically decomposable pseudo-words are processed by a morpheme access procedure, then naming latencies should be quicker than for non-decomposable pseudo-words.

They found that morphologically decomposable pseudo-words were read significantly faster than non-decomposable pseudo-words.

They conclude that *“the fact that naming latencies for morphologically decomposable pseudo-words were speeded up relative to morphologically non-decomposable pseudo-words is explicable by assuming that the former stimuli are pronounced by accessing morpheme-sized units in the lexical system (...) these results may be taken as support for the morphological composition hypothesis of lexical representation”*.

Laudanna et al. (1997) attempted to replicate the previous findings and extend their investigation to pseudo-words with partial morphological structure. These are stimuli where only one morphemic unit can be parsed (e.g., in 'cantovi' there is the stem 'cant-' but '-ovi' is not a suffix in the language; similarly, in 'canzevi', 'canz-' is not a stem in the language but 'evi-' is a legal suffix).

The participants (N = 21) were presented with pseudo-words, in three conditions:

1 - Full morphological decomposable structure (e.g., 'duriva': stem 'dur-' + '-iva', both legal morphemes in the language);

2 - Partial morphological structure (e.g., 'cantovi': legal stem 'cant-' + illegal suffix '-ovi');

3 - Non-decomposable morphological structure (e.g., deliso).

They found that pseudo-words with full morphological decomposable structure were read faster than either those with partial or non-decomposable morphological structures. No differences were found in latency times for the partially decomposable and non-decomposable stimuli.

They concluded that these findings replicated those in the first experiment, that fully decomposable morphological structure has an effect in naming pseudo-words when compared with the non-decomposable stimuli. Additionally, they showed that partial morphological structure is not sufficient to implicate the lexical system in accessing pseudo-words. Again, this supports models of lexical processing *"that postulate morphologically defined access units as well as morphologically decomposed lexical representations"* (p. 63).

A study in the French language (Gragner, Colé & Segui, 1991) discuss evidence about different models of representation of morphology (lexical, sub-lexical, both) namely Seidenberg's account (1987) claiming that frequency of letter clusters is the most important factor in word recognition. According to Seidenberg (1987), structural regularities such as morphemes also reflect changes in letter cluster frequency.

They defend the use of a masked priming paradigm because pattern masks and the very short duration of primes reduces prime visibility to a level that excludes the application of any predictive strategies.

They report two experiments. In the first, their aims were to test whether higher frequency morphological related primes would facilitate or inhibit target processing, and also, whether similar effects would be found with stems or derived (prefix and suffix) primes.

French adults (N = 40) were asked to make lexical decisions for targets that were of lower frequency than primes in a masked priming paradigm. Primes were of two types, morphologically related and unrelated to targets. In the related condition the following pairs of stimuli could be found:

1 - Derived prime / target pairs, either prefixed (e.g., 'prenom / surnom', meaning, first name / family name) or suffixed (e.g., 'mural /muret', meaning, mural / small wall);

2 – Stems, to prime either prefixed targets (e.g., 'nom / surnom', meaning, name / family name) or suffixed targets (e.g., 'mur / muret', meaning, wall / small wall).

In the unrelated condition primes had no relation with the targets.

It was found that target words preceded by morphologically related primes (stems and affixes) were responded significantly faster than when preceded by unrelated primes.

Facilitating effects of related primes were stronger for prefixed targets.

These results led them to conclude that stems and affixed higher frequency primes produce equivalent priming effects. The discrepancy between priming effects for prefixed and suffixed targets was not clear. They re-examined this finding in a second experiment.

In this second experiment, an orthographic control condition was added to examine whether morphological effects were solely due to orthographic overlap between prime and target. Target frequency was also manipulated with the use of low frequency and medium frequency targets. Whether discrepancy in effects with prefixed and suffixed targets was due to sharing initial or final segments with the primes was also controlled for.

The participants (N = 60) performed a lexical decision task. The pairs of stimuli were in three conditions:

1 – Morphologically related prefixed and suffixed prime / targets ('redire / dédire', meaning, repeat / deny);

2 – Orthographically related prefixed and suffixed prime / targets (e.g., 'redire / navire', meaning repeat / ship);

3 – Unrelated prime / targets

Again, significant effects of morphological relatedness were found. Latencies were faster in the morphologically related condition when compared either to the unrelated and or to the orthographically related conditions. A significant effect of target frequency was also found, with medium frequency targets responded to quickly than low frequency targets. No

significant differences were found for prefixed and suffixed targets in the morphologically related and orthographically related conditions.

These results allowed them to conclude that morphological priming is not a by-product of orthographic similarity. When measured against an orthographic baseline the effects of morphological priming are of approximately equal magnitude for prefixed and suffixed prime / targets. They also suggest that the present results stand as evidence against the hypothesis proposed by Seidenberg (1987) and strongly suggest the need to explicitly represent the morphemic structure of words in the processes of word recognition.

2.1.2 - Summary of main findings

To summarise this section, morphological priming studies have shown that:

- There are significant effects of priming when primes and targets are morphologically related (Murrell & Morton, 1974; Kempley & Morton, 1982; Emmorey, 1989; Foster & Azuma, 2000; Raveh & Rueckl, 2000; Laudanna, Badecker & Caramazza, 1989; Grainger, Colé & Segui, 1991);
- There are significant facilitating effects of priming when primes and targets are identical (Murrell & Morton, 1974; Kempley & Morton, 1982; Foster & Azuma, 2000; Raveh & Rueckl, 2000);
- There are mixed findings for the effectiveness of primes that share inflectional and derivational suffixes with the targets. Emmorey (1989) found no priming effects unless the suffixes shared the last syllable with the targets. Contrary to this, Grainger et al. (1991) provided evidence that inflectional and derivational

primes were similarly effective. This was also corroborated by Raveh & Rueckl (2000);

- Priming effects are not an artefact of visual / orthographic similarity or overlap with the targets (Murrell & Morton, 1974; Foster & Azuma, 2000; Laudanna, Badecker & Caramazza, 1989; Grainger, Colé & Segui, 1991);
- Priming effects are not artefacts of acoustic or phonological similarity (Murrell & Morton, 1974; Emmorey, 1989);
- Priming effects are not artefacts of semantic similarity (Emmorey, 1989);
- There are mixed findings for whether priming effects are not artefacts of prime and target frequency. Laudanna, et al. (1989) found no frequency effects because there were symmetric inhibitory effects for homograph unrelated high frequency primes and low frequency targets and vice-versa. Grainger, et al. (1991) found differential priming effects for medium- and high frequency targets.
- Speed of recognition (at least for pseudo-words) is facilitated by a full morphological structure of the stimuli. Partial morphological structure is not enough (Laudanna, Cermele & Caramazza, 1997).

Thus, there is strong evidence for a facilitating effect of morphological relatedness between primes and targets. These findings were obtained by studies that used different priming approaches, either delivering the primes in pre-training phases or contiguously to the targets. Additionally, morphological priming effects appear to be highly specific, i.e. non-explainable by simple semantic, phonological and orthographic similarities. In different alphabetic languages, the results have shown that words are accessed via their

morphological structure. The morphological structure of primes (a full morphological structure) enhances speed of recognition or amount of accuracy in processing the morphological structure of the targets.

No studies attempted to examine whether this strong and highly specific pattern of findings could be conceptually used to understand how children use morphological information when they spell words that are not transparent. Nothing is known of whether / when children are sensitive to primed morphological information or what types of primes are, if at all, effective.

New research is necessary to examine whether it is reasonable to expect that a methodology that has been found so consistently effective with adults is sensitive enough to enhance access to morphemes when children spell non-transparent words.

The next section reviews studies that use children as participants and examine how they develop their spelling of words that require morphology, and what factors might underpin such development.

2. 2 - Representing morphemes in the spelling: developmental trends and contribution of morphological awareness

Bryant, Nunes & Aidinis (1999) proposed a classification of situations in which the spelling is determined by morphology:

- 1) when there are conventional spellings of morphemes that flout letter-sound correspondence rules;
- 2) when there is more than one possible spelling for the same sound, and
- 3) when morphemes are silent.

The aim of this section is to review evidence of those three situations, focussing on models of spelling development and on the role of morphological awareness as a predictor of children's morphological spelling.

2.2.1 – When there are conventional spellings for morphemes that flout letter-sound correspondence rules

Most of the developmental research about the conventional spelling of non-transparent morphemes has focused on the study of stems (Aidinis, 1998; Carlisle, 1988; Derwing, Smith & Wiebe, 1995; Nunes, 1998; Treiman, 1994). Stems are the basic units of meaning in words and therefore the most salient in their morphemic structure. Their pivotal role as determiners of word structure has been highlighted in the previous section. Research on Morphological Priming has systematically shown that morphologically related stem-primers facilitate access to the morphological structure of targets, whilst homophone unrelated

stems produce inhibition, and a full morphological structure that includes the stem is necessary to facilitate recognition of pseudo-word targets.

One of the ways to make sure that children have built up some understanding of the structuring nature of stems is to examine how the ability to spell stems consistently in base and derived words develops. Keeping stems consistent when spelling base and derived words, when the latter has a phonologically altered stem, is a sign that at least implicitly, morphological processes may be in place. On the other hand, spelling suffixes whose spelling draws upon its nature as a morpho-syntactic marker and not upon its pronunciation, is an indication that children are starting to master this complex issue. In the next two subsections, some studies examining these issues are reviewed.

2.2.1.1 – Conventional spelling of stems

Frequently, stems in base and in derived words are pronounced differently, but nevertheless spelled consistently (e.g., heal - health; magic - magician). Other times, despite changes in the pronunciation, the spelling of stems has to take silent letters (e.g., know – knowledge) into account. In even more complex cases phonological and orthographic changes may take place (e.g., deep – depth).

Several studies have tried to understand whether children use the morphological information from stems in base words to spell the same stems in derived words.

Treiman, Cassar & Zukowsky (1994) raised the possibility that very young children could grasp morphological information from the stem in base-words when spelling the same stem in two-morpheme words.

Treiman et al. (1994), conducted four experiments to examine what types of linguistic information children use when spelling words containing /t/ and /d/ 'flaps'. They give as examples the words 'writing' and 'riding', where the middle consonants [t] or [d] are voiced flaps '*phonetically voiced as /d/*' (p. 1319) in the American Variant of English. In the first two experiments children had already been found to use a bias [d] to spell both /t/ and /d/ flaps. They found evidence (Experiment 3) that children, as young as first graders, could spell flaps in two-morpheme words more accurately than in one-morpheme words. According to Treiman et al. (1994), this suggested that first grade children had some ability to use morphological information from the stem. For example, when spelling two-morpheme words such as 'dirty' children would access the stem 'dirt' and realise that the final consonant [t] keeps its spelling in 'dirty', despite the [t] being pronounced as a /d/ flap. Such information would not be available in one-morpheme words such as 'duty', which does not have the stem 'dut', and therefore children would be more likely to spell the [t] with [d] according to the pronunciation.

Experiment 4 was set to investigate whether even younger children could show such ability. In this study, kindergarten, first and second graders were asked to complete the spelling of one- and two-morpheme words with /t/ and /d/ flaps, and of un-flapped control words. All they had to do was to add [t] or [d] in blank spaces provided on an answering sheet where the remainder of the words were already spelled. Children were tested twice, over a five-month interval.

They found that in all grade levels, /d/ flaps were more accurately spelled with [d], than /t/ flaps were accurately spelled with [t]. Kindergarten and first graders were more accurate in spelling flaps in two-morpheme words than in one-morpheme words. They also found that

the spelling of stem flaps was more accurate than the spelling of two-morpheme word flaps. According to the researchers, this suggested that although children did not use the morphological information of the stems fully, they were able to incorporate some morphological information in the spelling of two-morpheme words. This was proposed as evidence that from an earlier age meaning relations between morphologically related words had a significant influence on the spelling of flaps. As Treiman & Cassar later point out, this *'speaks against the view that the use of morphological information in spelling is a late development'* (Treiman & Cassar, 1997, p. 75).

It is unclear, in this study, whether /t/ and /d/ flaps can be analysed together. This is because of the impossibility to separate the effects of phonological and morphological processes in /d/ flap words because both coincide: the flap is voiced as /d/ and the spelling is also represented by [d]. This is not the case for /t/ flaps that are voiced as /d/ but spelled morphologically with [t].

What is thus claimed to be morphologically influenced in /d/ flaps, can be sorted out by the use of a more simple phonological strategy. In fact, if children use a straight phonological strategy, spelling /d/ flaps with [d], they will be 100% correct. The fact that they may use this basic process is outlined by the mean proportion of correct spellings that is reported (Table 9, p.1332). There, kindergarteners have an equivalent amount of improvement over a five-month period, either in stem /d/ flap words or in one-morpheme and in two-morpheme /d/ flap words. They must therefore use the same type of strategy in all contexts and across the time interval. Consistent with this interpretation is the fact that no improvement exists, over the same period, for two-morpheme /d/ flap words in the first and the second grades, and the same is true for one-morpheme words in the first grade.

When spelling /t/ flaps a different pattern emerges. If children use the same phonological approach they would more frequently spell /t/ flaps with [d], and indeed this was what emerged from experiments 1, 2 and 3. If they followed such approach, they would be 100% wrong. In order to spell /t/ flaps with [t] in two-morpheme words, a morphological approach is needed because children have to consider the morphology of the stem. What the mean proportion of correct spellings suggests however, is that their ability to use morphological information from the stem is rather weak. It is below chance level in kindergarten and hardly rises above 50% chance level in first grade children. Second graders also show an equivalent amount of progression for one and two-morpheme words. This last piece of evidence clearly suggests that sources of information other than morphology of the stem alone are as useful to spell one-morpheme as two-morpheme words. This lack of difference between one and two-morpheme words may be related to the over-simplicity of the spelling task (children only had to spell [d] or [t]). Added to this is the absence of control for word knowledge effects, because no pseudo-words were used. To summarise, /d/ and /t/ flap words require different processes in their spelling and, in accordance, should be analysed separately. Moreover, only /t/ flap words require morphological considerations. Children, at the end of the second grade, show some ability to spell the later words correctly. However, because that ability is unspecific for two-morpheme words, variables other than morphology appear to play a concurrent role and therefore might be accounted for. Thus, if /t/ flaps are analysed separately, the claim that two-morpheme words are significantly better spelled because children capture morphological information from the stem, becomes less clear. Treiman (1994) claims that the higher scores in the accurate spelling of flaps in two-morpheme words is a sign that children are using morphological information from the stem, but there is no independent measure of morphological awareness. It could be that children are spelling words using

some proportion of rote learning, given also the fact that many of the words used were high-frequency monosyllables.

Fowler & Liberman (1995) examined whether morphological knowledge, reading skill and spelling knowledge are interrelated.

The participants (N = 48) were children from 7.5 to 9.8 years of age, in the second, third and fourth grades. Children were assigned into three reading level groups (Low; Mid; High), matched on age, sex and verbal IQ (PPVT-R). They were assessed on Reading and in Spelling, with standardised measures. A test of Morphological Production, adapted from Carlisle (1988) was used to assess morphological awareness. This test contained pairs of base – derived words in two conditions, phonologically complex (e.g., five / fifth) and phonologically neutral (e.g., four / fourth). In both conditions, the derived words were formed by adding six common suffixes to the base-forms. Children were presented with 72 sentences. In half of them, the base-word was provided and children supplied the corresponding derived-word (e.g., ‘Four. The big racehorse came in ____’). In the other half, the derived-word was provided and the child supplied the related base-word (e.g., ‘Fourth. When he counted the puppies, there were ____’). Children performed the derived forms sub-test first and the base forms sub-test immediately after. All responses were given orally.

They found that the production of base forms was significantly easier than derived forms. On the other hand, phonologically neutral items were significantly easier than phonologically complex items.

Partial correlations and stepwise multiple regressions showed that after controlling for differences in age and vocabulary, the ability to produce the base-form when given phonologically complex derived-words was highly correlated and the best predictor of reading. Again in the phonologically complex condition and after controlling for differences of age and vocabulary, spelling was best predicted by the ability to produce the derived-form when given the base-form. These predictors still stood, in a more stringent series of hierarchical multiple regressions when differences for age, vocabulary and the remaining sub-tests of the morphological production task were first controlled for.

When reading level groups were analysed, they found that skilled readers were superior in both tasks (producing the base when the derived was given and vice-versa) of the phonologically complex condition. There were no differences, however, in both tasks of the phonologically neutral condition.

No significant difference in morphological production was found between older and younger readers matched on reading attainment.

They concluded that morphological awareness is interdependent with reading and spelling. This interdependence is better explained when knowledge about morphologically complex and phonologically complex words is considered. When reading levels are considered *'poorer readers are disproportionately affected by the phonologically complex items relative to the better readers'* (p. 175). They also suggest that *'orthographic knowledge is a powerful source of information regarding morphological relationships'* (p. 180).

Other researchers have also examined the interrelations between morphological awareness and spelling knowledge.

Nunes (1998) conducted a longitudinal study examining how children developed the ability to spell stems consistently and how morphological awareness explained that development. Children in grades one, two and three, spelled stems in word pairs formed with real words with changes in the stem phonology (e.g., know - knowledge) and pairs formed by a real word and a pseudo-word whose stems carried silent consonants or digraphs (e.g., knot - knotosaurus). Children spelled the first word in the pairs on one day. On a separate day, they spelled the second word (or pseudo-word) in the pairs. Assessments for morphological awareness were also taken on several occasions. It was found that the ability to use consistency in the spelling of stems followed a developmental trend, i.e., children improved this ability as they grew older. Multiple regression analyses in which the dependent variable was consistency in the spelling of stems showed that morphological awareness measures taken two years before the spelling predicted consistency in the spelling of stems, even after partialling out the effects of age and general verbal ability.

Conversely, children's level of accurate morphological spellings of stems at an earlier age also predicted their level of morphological awareness two years later. She concluded that there is a mutual enhancement between morphological awareness and spelling knowledge.

Aidinis (1998) replicated this same trend of findings in a cross-sectional study with 214 Greek children aged 7 to 10 years. He examined whether children's awareness of the morphological connections between words with the same stem helped them to spell the stems consistently. Children were asked to spell 20 pairs of words and non-words, presented without sentence context. The first item in the pair was always a word. In the first ten pairs the first item was a single word (one stem), and the second item was a real

word derived from the first. In the remaining ten pairs the first item was a real compound word (two stems) and the second item was a compound pseudo-word formed by substituting the first stem of the first item with another real stem. This is a combination that does not exist in the Greek language. The stems contained sounds for which at least two acceptable phonological representations existed. The correct representation, however, was dependent on morphology.

He found that 9- and 10-year-old children used morphology to spell the stems consistently more often than 7- and 8-year-olds did. The latter age groups were not significantly different. Multiple regression analyses showed that consistency in the spelling of stems was predictable from children's morphological awareness after controlling for the effects of age and verbal ability. In these analyses, three measures of morphological awareness adapted from Nunes et al. (1997 a), the Sentence Analogy, the Word Analogy and the Productive Morphology tasks, were found to contribute with unique variance to the regression equation.

He concludes that there is a developmental trend in the ability to spell stems consistently and that morphological awareness is a core process in explaining this development.

Some studies attempted to investigate how older children mastered the morphology of stems. One such study (Carlisle, 1988) examined how the complexity of phonological and orthographic transformations between stems influences children's spelling processes. The second aim of the study was to examine how knowledge about the morphology of derivational processes influences the spelling of derived words.

Children (N = 65) in the fourth, sixth and eighth grades were assessed with a Morphology Test and a Spelling Test. In the Morphology test, children had to supply the base form in sentences where the derived form was provided (e.g., 'Warm. He chose the jacket for its _____') and, conversely, supply the derived form where the base was provided. Children's answers were given orally. In the spelling test, children were asked to spell base and derived words. Each word to spell was presented first alone, then in a sentence, and finally alone. Children spelled the derived forms in one day and the base forms one week later.

Four types of morphological transformations, in which the degree of morphological complexity increases, were assessed. In the first, there is no change between the base and derived form (e.g., enjoy- enjoyment). In the second, there was no phonological change but a minor orthographic change (e.g., rely - reliable). In the third, there is a phonological change but no orthographic change (e.g., magic - magician). Finally, pairs with both phonological and orthographic change were used (e.g., deep, depth).

From grades four to eight a significant developmental progression was found in children's knowledge of morphological relations. Similarly, children showed a significant improvement with grade in the spelling of both base and derived forms. Base forms were more successfully extracted from derived forms and more proficiently spelled. Conversely, derived forms were more difficult to extract from base forms and less correctly spelled. Children were less accurate in providing base and derived forms orally, especially when they required phonological and /or both phonological and orthographic transformations. In all four levels of complexity, accuracy in the spelling of derived words increased significantly with grade.

Carlisle (1988) concluded that there are strong developmental trends in the development of awareness of derivational morphology from the fourth to the eighth grades. She also

concluded that accuracy in accessing and spelling stems in derived words improves with grade and reflects the level of complexity of the transformations between base and derived forms.

Another study that tried to examine the relation between morphological knowledge and orthographic knowledge in older children was conducted by Smith (1987), as reported in Derwing, Smith & Wiebe (1995).

Smith (1987) conducted an exploratory qualitative study designed to examine the effects of spelling knowledge in identifying stem morphemes in derived words. The hypothesis was that there is a reciprocal relation between spelling and morphological knowledge and that *'spelling similarities can give rise to morphological insights perhaps at least as readily as morphological awareness can lead to improvement in the skills of writing and reading words in English'* (p. 5).

Children (N = 207) from grades 4 to 7 were included in the study.

A spelling task consisting of 60 pairs of base – derived words was constructed. The pairs had different degrees of orthographic, phonological and semantic similarity. There were also some compound words (e.g., necklace) and words with less obvious relations (e.g., cave / cavity) or even false etymological relations (e.g., fry / Friday).

Children's answers were scored as S (same spelling of the stems in the base and derived word) and as D (different spelling of the stems in the pair).

A morpheme recognition test was also devised, consisting of 11 pairs of base – derived words, a sub-sample of the pairs in the previous task. This task was administered only to a sub-sample of the subjects (N = 96).

Children were asked five questions related to the morphological relations in each word pair. Because the researcher was more interested in validity issues, the use of different questions intended to assess which of them would show greater explaining power and higher inter-correlations.

Children were asked:

- 1 – What is the meaning of the derived word?
- 2 - Why is a (e.g., teacher) called a (e.g., teacher)?
- 3 – Does the word (e.g., teacher) come from any other word you can think of?
- 4 – What is the meaning of the base word?
- 5 – Do you think the word (e.g., teacher) comes from the word (e.g., teach)?

Questions 1 and 4 were used to check for explicit knowledge of meaning relations.

Questions 2 and 5 were adaptations from morphology tasks devised by Berko (1958).

Question 3, developed by the experimenter, was intended to be a more rigorous version of question 5. This was due to the possibility that many children might reply affirmatively to question 5 because it elicits a ‘yes’ response, a positive bias effect, independently of explicit awareness of the relations involved.

Preliminary analyses of the results in the morphology test led to the elimination of questions 1 and 2, which did not correlate with each other. Some item pairs in the test were also eliminated because their stems were recognised by almost any child (e.g. *preside*, in the pair *preside / president*).

Taking only into analyses those children who showed awareness of the base stem (that were successful in question 4) Smith found that in around half of the pairs S-spellers performed significantly better than D-spellers, when providing answers for question 3 in the morphology task. He also found that those children that were successful in question 5, and those who simultaneously succeeded in questions 5 and 3, were more likely to be S-spellers. This was only true when word pairs with quite transparent relations (e.g., *draw / drawer*) were used. For the remaining items, however, there were no significant differences between S-spellers and D-spellers.

Smith (1987) concluded that there is a relation between the ability to spell stems consistently (S-spellers) in base and derived words and morpheme recognition, but this relation is clearer in word pairs that are relatively transparent. He also suggests that S-spellers may have access to a wider number of '*different cognitive associations*' (p. 14) to examine words and their morphemes than D-spellers.

Derwing, Smith and Wiebe (1995) also report a second study conducted with adults where the same methodological approach was used. Similar to the findings with children, they found that S-spellers were more likely to recognise the morphemes involved in some of the items, especially in those with a '*reasonably transparent semantic connection*' (p.21). The authors conclude that there is an influence of spelling knowledge on morphological judgements, although the direction of influence may be reversed in less transparent items.

2.2.1.2 – Conventional spelling of suffixes

Another instance in which morphemes have conventional spellings that flout letter-sound correspondence rules has to do with the spelling of suffixes.

Nunes, Bryant & Bindman (1997a) conducted a longitudinal study on the development of morphological strategies that are needed to spell the regular past-tense ‘-ed’ morpheme accurately. English children (N = 363) in grades 2, 3 and 4, from eight different schools in London and Oxford, were involved. The study lasted for three years and data from the three initial sessions of observation covering a period of 20 months are reported. Children were asked to spell 30 words, in a task containing other words not related with the ‘-ed’ morpheme. The words were matched for frequency and contained 10 regular past ‘-ed’ verbs, 10 irregular past verbs whose final consonant was phonetically spelled, and 10 non-verbs also phonetically spelled. Half of the words in the list ended on a /d/ sound, the remaining half, ended on a /t/ sound. Children’s morphological awareness was evaluated using three tasks devised for the study: the Sentence Analogy task, the Word Analogy task and the Productive Morphology task. IQ (WISC) and Reading Age (Schonell) were also assessed as control factors.

They found that the spelling of the ‘-ed’ morpheme follows a complex pattern whose development could be represented in a sequence of stages:

- Stage 1 – Unsystematic spelling of endings. Children, for example, failed to spell the ending morphemes or added something unrelated to the expected ending;
- Stage 2 – Frequent phonetic transcriptions of endings. Children spelled regular past verbs phonetically failing to produce the conventional ‘-ed’ morpheme (e.g. ‘kist’);

- Stage 3 – Some ‘-ed’ endings were already spelled but children overgeneralised them to irregular verbs and non-verbs (e.g., ‘kissed’, but ‘sleped’ or ‘sofed’);

- Stage 4 – The ‘-ed’ spellings are confined to past verbs with generalisations to irregular verbs (e.g., ‘kissed’, ‘soft’ but ‘sleped’);

- Stage 5 – The ‘-ed’ spellings are systematically confined to regular past verbs only, with no overgeneralisations to irregular verbs (e.g., ‘kissed’, ‘slept’, ‘soft’).

The researchers tested the stage model according to whether: (1) each child clearly belonged to one of the stages; (2) advance in age and educational success fit with stage position; and, (3) children moved from less to more advanced stages overtime, and not in the opposite direction. Although a minority of children were found to backslide in the sequence of stages, the developmental model provided a reasonable fit for the longitudinal data.

Morphological awareness measures, Sentence Analogy and Word Analogy (but not the Productive Morphology task) were found to be significantly related to the stages children were assigned to, even after controls for differences in age and IQ.

Multiple regression analyses showed that Word Analogy and Sentence Analogy measured at the beginning of the study, predicted the number of correct ‘-ed’ spellings 7 months later; Word Analogy continued to be a good predictor of the number of correct ‘-ed’ spellings 20 months after the beginning of the study. In both analyses stringent controls for differences in age, IQ and the children’s initial spelling levels were performed. These results indicated that a strong link existed between children’s initial morphological

awareness and their subsequent success in learning that they should use the conventional ‘-ed’ at the end of regular past verbs.

Overgeneralisations, described in the stages three and four, shone a new light on the developmental processes underlying spelling. Young learners start looking for regularities in the language in order to understand the orthographic system. Then tend to apply those regularities to broader contexts where they do not fit, before restricting their use to the appropriate contexts.

They conclude that *“the first step in spelling is to adopt a phonetic spelling strategy; the next step is to notice and try to incorporate exceptions to these rules but without a complete understanding of their grammatical basis; the next step is to understand fully this grammatical basis for some of the spelling patterns that do not fit well with the letter-sound rules; the final step is to learn about the exceptions to the grammatically based rules”* (pag.647).

In order to control for any lexical effects related to the fact that rote learning might have influenced children’s spellings of the ‘-ed’ morpheme in regular verbs, Nunes, Bryant & Bindman (1997b) conducted two other longitudinal studies using regular and irregular pseudo-verbs. They attempted to investigate whether:

- the same developmental improvement could be found with pseudo-verbs with inflectional morphemes;
- children could make the regular – irregular distinction in pseudo-verb tasks;

- there would also be a close relationship between accurate spelling of the morphologically based inflections and morphological awareness scores;

Children (N = 289) aged between 7 and 11, participated in the first of these studies. In session 6 of the three-year longitudinal study children completed two spelling tasks. The first was composed of 5 regular and 5 irregular pseudo-verbs in the context of sentences given orally and in written format. The second spelling task was made of 10 real regular verbs and 10 real irregular verbs all ending in two-consonantal sounds, the last consonant being either /d/ or /t/. The spelling tasks were presented orally.

In previous sessions, children also had been tested for morphological awareness with a Word Analogy task (Session 1) and for IQ with a shortened version of WISC (III) – three months after Session 1.

Two different analyses were performed, one evaluating how the number of ‘-ed’s varied with age and verb type (regular or irregular pseudo-verbs), the other looking at how the number of phonetic endings varied with age and pseudo-verb type.

As to the number of ‘-ed’ endings, they found that:

- there was a significant and consistent increase with age in the number of ‘-ed’s placed at the end of past verbs;

- regular pseudo-verbs were more significantly spelled with ‘- ed’ than irregular pseudo-verbs;

- there were significant age differences in the number of '-ed's placed at the end of regular verbs but no significant age differences in the number of '-ed's placed at the end of irregular verbs;

As to the number of phonetic endings, they found that:

- older children produced significantly less phonetic endings than younger children;
- significantly more phonetic spellings were produced with irregular than with regular pseudo-verbs;
- older children produced significantly less phonetic endings with regular pseudo-verbs and no significant age differences existed in the number of phonetic endings with irregular verbs.

In order to verify whether a common process could explain both spellings of real verbs and pseudo-verbs, partial correlations were computed between the pseudo-verb scores (first spelling task) and scores in real verbs (second spelling task), partialling out the effects of differences in age and IQ.

Significant correlations ($p < .001$), were found, indicating that children who spelled morphologically with '-ed' tended to use that strategy both with regular real verbs and with regular pseudo-verbs. Conversely, those children who spelled phonologically tended to use that strategy both with irregular real verbs and with irregular pseudo-verbs.

This pattern of correlations suggested that when spelling real verbs children were not just using lexical awareness or lexical familiarity with words, since the same process could not be productive with pseudo-verbs.

Multiple regressions showed that morphological awareness, measured 21 months before, made a separate and independent contribution, predicting children's spelling of '-ed's in regular pseudo-verbs, even after controlling for the differences in children's age and IQ.

Nunes et al. (1997, b) raised the possibility that analogy of the pseudo-verbs with real regular and irregular verbs could explain some of the results found. This was because all the pseudo-verbs used in the study rhymed both in the present and in the past with at least one real verb, forming analogous pairs.

In order to control for this possibility a second study was undertaken with a spelling task containing 4 regular pseudo-verbs that were analogous to real regular verbs, 4 irregular pseudo-verbs that were analogous to real irregular verbs and 2 irregular pseudo-verbs that were non-analogous to real irregular verbs.

With this control for analogy effects, they continued to find that regular pseudo-verbs were mostly spelled with -ed, younger children doing this less frequently than older children. Phonetic endings were mostly spelled in irregular pseudo-verbs, in both analogous and non-analogous conditions. Morphological awareness, measured by the Word Analogy Task 33 months before, were found not to predict the number of '-ed' spelled in regular pseudo-verbs in the final session of the longitudinal study, after the differences in age and IQ had been partialled out.

From the last two studies different conclusions were reached. Firstly, that learning about the conventional spellings of the inflectional morpheme in past verbs undergoes considerable development between the ages of 8 to 10 years. Secondly, children make a distinction between regular and irregular pseudo verbs assigning more '-ed' spellings to

the first and more phonetic endings to the latter. This distinction can sometimes be made by analogy with real verbs but there is also the possibility of some understanding of the morphological rule when analogies are not possible. Thirdly, morphological awareness makes a specific and independent contribution to the learning of this spelling pattern in the first study, predicting spelling over a period of 21 months. The lack of a predictive relationship found in the second study a year later, is attributed to the *'effects of children's experiences in the classroom and elsewhere during the further year'* (p.446). Or, as stated later, to the possibility that *'other factors exert more powerful influences in the long run'* (p. 447).

Finally, the consistent pattern of results indicating that children were more likely to spell the inflectional morpheme '-ed' at the end of regular (real and pseudo-verbs) than irregular verbs suggests that children learn about the distinction between regular and irregular verbs – *'a quite sophisticated orthographic rule'* (p. 448) – informally.

Bryant, Nunes & Snaith, (2000), pursued the search for whether children can learn spelling rules informally, again looking at the spelling of the '-ed' morpheme.

One such rule that is not taught in schools, is that verbs that have the same stem in the present, and in the past take the '-ed' morpheme in the past tense. If the stem changes, then the past tense form is spelled phonologically.

They conducted two experiments with 102, eight- and nine-year-old children. These were required to write pseudo-verbs in the past tense, in sentences that either had the same stem in the present and in the past or not.

They hypothesised that if children show some awareness of the morphological rule they would be more likely to spell the same-stem pseudo-verbs with ‘-ed’ and the different-stem pseudo-verbs phonologically.

Children listened to sentences where the present tense stem appeared twice and the past-tense stem appeared once. In half of the sentences the stem did not change in the present and in the past (e.g., ‘Harry is a chailer. At the moment he is chailing the teacher’s book. He **chailed** another one this morning’ – my emphasis in bold); in the other half, the stems changed (e.g., ‘Harry is a cheller. At the moment he is chelling the teacher’s book. He **chaild** another one this morning’ – my emphasis). The sentence was written on the answering sheet minus the past pseudo-verb (in bold) where a blank space existed. The target pseudo-verbs were pronounced in exactly the same way in the two types of sentences. Only the configuration of the sentence (same stems / different stems in the present and in the past) changed. While listening to the sentence, the children were asked to fill in the blank space.

It was found that pseudo-verbs with the same stem in the present and in the past received a significantly higher percentage of ‘-ed’ spellings. Conversely, pseudo-verbs whose stems differed were more often spelled phonologically.

They concluded that children learn this quite sophisticated rule informally. They also propose that a third processing mechanism regarding how words are spelled needs to be considered. Dual-route models (Castles & Coltheart, 1993) propose that words can be spelled either phonologically (phoneme-grapheme conversion) or lexically (as whole words retrieved from memory). This second route, however, does not account for the use of morphological spelling strategies, as shown in this study. Thus, they propose that words can be spelled phonologically when there is sound-to-letter transparency, and lexically and

morphologically when that is not the case. A morphological route to spelling is stressed because *'the morphemic structure has a radical effect on the way that children spell known and unknown words'* (p. 157).

2.2.1.3 – Summary of main findings

At the end of this section, it is important to draw a summary of the evidence reviewed, emphasising how the spelling of morphemes that flout letter-sound correspondence rules develops and the role of morphological awareness in predicting such development.

The first issue is that there is conflicting evidence on whether morphological spelling is found earlier or later in development. On the one hand, Treiman et al. (1994) suggested that young children could show early signs of use of morphological information on the spelling of final consonants in the stem of two-morpheme words containing 'flaps'. On the other hand, there is no suggestion that this might be the case in studies dealing with consistency in the spelling of stems (Nunes, 1998; Aidinis, 1998; Carlisle, 1988). There are profound methodological differences between the studies that make comparisons difficult. For example, Treiman et al. did not control for lexical effects or rote learning.

Additionally, they did not provide a specific measure of morphological awareness allowing interpretation of children's performance as based on such awareness. Nunes (1998) and Aidinis (1988) provided those controls and these researchers, as well as Carlisle (1988), developed morphological awareness measures attempting to examine whether a relation existed between morphological awareness and spelling knowledge. This latter issue was

also the object of research by other researchers such as Fowler & Liberman (1995), Smith (1987) and Derwing et al. (1995).

The second issue deals with the role of morphological awareness in influencing spelling that requires morphology. Consistent evidence supporting such a role was found in different studies. Fowler and Liberman (1995), for example, stressed the interdependence between morphological awareness and spelling (as well as reading). In the same direction, Nunes (1998) showed how morphological awareness predicted consistency in the spelling of stems but, conversely, could be predicted from spelling knowledge. Carlisle (1988) stressed the role of awareness of derivational morphology in the spelling of stems that involved transformations with increasing levels of complexity. Smith (1987) suggested that a certain degree of transparency of the morphological relation between base and derived words was necessary so that a significant influence of morphological recognition could be postulated.

The role of morphological awareness as a predictor of spelling knowledge that involves grammatical distinctions, such as is the case of distinguishing between regular and irregular verbs in the past-tense, received strong support in the series of longitudinal studies by Nunes et al. (1997 a, b). These studies established that spelling development progressed from phonological to morphological strategies and explained the role of overgeneralisations as inter-mediators in such progress. They suggested that the spelling choices in regular and irregular (real and pseudo-) verbs were not random. Children appeared to build up some awareness of a morphological rule that is necessary to allocate the conventional ‘-ed’ morpheme to regular past verbs more frequently than on irregular

past verbs (either in real verbs and pseudo-verbs). This finding was replicated on a more recent experiment (Bryant et al., 2000).

Thus, despite methodological differences, the early vs. later debate on the emergency of morphological spelling strategies, continues opened. It is not the aim of this thesis to contribute directly to this debate, although relevant information might arise from the studies reported here. The main aim is to examine the development of spelling that flouts letter-sound correspondence rules and whether there is also a strong, predictive, role of morphological awareness, similar to what is clearly supported in the evidence reviewed.

The next two sections, review the evidence on the remaining situations where spelling requires morphology, according to the classification proposed by Bryant et al. (1999).

2.2.2 – When there is more than one possible spelling for the same sound

A second situation in which morphology is necessary (Bryant et al., 1999) occurs when the same sound or sequence of sounds takes different spellings, and the discrimination of these spellings is based on the grammatical function of the word.

2.2.2.1 – The spelling of grammar based homophone morphemes

Words that end in suffixes that are homophone are an example of this situation in the Portuguese language.

Nunes Carraher (1985) examined how school-aged Brazilian children spelled the homophone suffixes 'isse' and 'ice' that are spelled differently, according to the grammatical status of the words. The suffix 'isse' represents the subjunctive inflection of some verbs and 'ice' is a derivational suffix that forms abstract nouns.

Children were asked to spell non-existing combinations of real stems and suffixes, embedded in a context that made their grammatical status clear. It was found that younger children tended to use one pattern of spelling for the two suffixes, showing no awareness of grammatical distinctions, whilst older children tended to spell both morphemes according to the grammatical status of the pseudo-words.

Nunes Carraher (1985) suggested that when confronted with sounds that can take different spellings younger children tend to use one pattern only, irrespective of grammatical distinctions. They then start a process of using more than one pattern, not necessarily in the right contexts, until they reach a greater degree of systematic assignment.

In another study, the same researcher (Nunes, 1992) examined how first to eighth graders spelled the ending sound /ãw/, which in Portuguese can be represented as [-ão] or [-am]. This spelling is governed by one contextual rule related to the stress in the word. In words in which the ending is unstressed it is usually represented as [-am]. When stressed it is represented as [-ão]. Another rule has to do with semantics: in nouns and in verbs in the third person plural of the future tense, it is spelled as [-ão]. In the third person plural in the past tenses, it is spelled as [-am]. The participants were children from the first to the eighth grades (n= 64), 8 children from each grade, from one school. They were asked to read and

spell non-words appearing in the context of an invented story.

Nunes (1992) found that reading and spelling non-words ending in [-ão] was not a problem from the first grade and onwards. In fact most children spelled the sound /ãw/ with only one of the spelling alternatives, the [-ão]. As for the reading and spelling of [-am] different patterns emerged. Accurate reading was achieved by a large percentage of children from the second grade onwards, the spelling taking up to the eighth grade to be accurately performed by most children.

Another Brazilian researcher (Da Mota, 1995) examined two cases of the same phenomenon in Portuguese (Study 5). The first was the spelling of the homophone suffixes ‘-am’ and ‘-ão’ used at the end of verbs in the third person plural of the past tense (e.g. ‘pensaram’, meaning ‘they thought’) and of the future tense (e.g., ‘pensarão’, meaning ‘they will think’).

The second case deals with the homophone suffixes ‘-esa’ and ‘-eza’ appearing in feminine words that indicate origin (e.g., ‘Portuguesa’, meaning Portuguese) or in abstract nouns (e.g., ‘beleza’, meaning beauty).

Because a phonological rule based on the stress is sufficient to disambiguate the spelling of ‘-am’ and ‘-ão’, it is unclear whether one needs to approach the spelling of these morphemes morphologically. As for the second case, no consistent conclusions can be drawn because the spelling task contained only three ‘-esa’ words and three ‘-eza’ words. This is markedly insufficient to control for chance effects and other extraneous factors. Lexical knowledge was also not controlled for with the use of pseudo-words.

Aidinis (1998) examined the same issue in the Greek language. In Greek, there are alternative spellings for words ending in the sound /i/. Feminine singular nouns take the ending / η/, neuter singular nouns end in /ι/, masculine plural nouns and adjectives take the ending /οι/ and third person singular active verbs in one conjugation take /ει /. Because these morphemes convey meaning and grammatical function, discrimination of which spelling to use is necessarily based on morphology.

Children from grades two to five (7- to 10-year-olds) performed a spelling task with words and pseudo-words. Half of the sample was assessed for morphological awareness with Word Analogy, Sentence Analogy and Productive Morphology tasks.

Aidinis (1998) found that when there are alternative spellings for the same sound, a group of younger children showed a marked preference for one of the alternative spelling patterns. In an intermediary stage, some older children used the alternative spelling patterns both appropriately and inappropriately. Children start to understand the morphological basis of these spelling patterns by the fifth year of schooling.

After controlling for age and verbal ability, a significant relation was found between each of the measures of morphological awareness and the spelling of word endings.

He concludes that his findings support Nunes et al.'s findings (1997 a, b) both for the developmental sequence in the spelling choices that children make and for the role of morphological awareness as explaining such development.

2.2.2.2 – Summary of main findings

The case of homophone suffixes in Portuguese is a rich situation in which to analyse morphological spellings as they require the discrimination of one suffix in relation to the other, and because the grammar status of the words is determined by the suffix.

However, none of the above studies used longitudinal designs and there was no control for the relation between morphological awareness and discrimination in the spelling in Nunes Carraher (1985) and Nunes (1992). Da Mota (1995) used a Productive Morphology task and a Grammatical Analogy Task to assess morphological awareness. However, a relation can not be proposed because phonological awareness is enough to disambiguate the spelling of ‘-am’ from ‘-ão’ and the spelling task does not have enough stimuli to, reasonably, assess discrimination of the homophone suffixes ‘-esa’ and ‘-eza’.

The cross-linguistic evidence presented by Aidinis (1998) suggests that grammar-based spellings require morphological awareness. However, his findings were cross-sectional and the relation with morphological awareness was only looked for in the spelling of words. Even though he controlled for verbal ability one can not exclude that some spellings were based on lexical knowledge.

2.2.3 – When silent morphemes have to be spelled

A third situation where morphology is required (Bryant et al., 1999) deals with the spelling of silent morphemes. This poses an additional challenge to the children because they are

required to spell something that is not pronounced. Examples of this are the spelling of the apostrophe in English and the spelling of plural markers for nouns, adjectives and verbs in French.

2.2.3.1 – The case of silent morphology

Bryant, Devine, Ledward and Nunes (1997) examined whether it was possible to enhance English children's spelling of the apostrophe. It can be spelled in two different configurations, ['s] for genitive singular nouns and [-s'] for genitive plural nouns. The apostrophe does not represent any sound. It is a "pure" example of a spelling distinction based entirely on grammar. In order to investigate how this understanding develops, Bryant, Devine, Ledward and Nunes (1997) conducted two intervention studies with English children, aged nine to twelve years. Their aims were to examine how well children knew that apostrophes could denote possession, before and after been taught that at school, how sensitive this knowledge was to intervention, and how morphological awareness was related to improvements in the spelling. In both studies children were matched for spelling age (Schonell Graded Word Spelling Test B) and year group, into three intervention groups: the Experimental, Taught Control and Untaught Control.

Seventy-five, 9- to 12-years-old children, participated in the first study. They were in years 5, 6 and 7. They were pre-tested and post-tested with a set of 16 sentences designed to measure their awareness that the apostrophe was used with genitives but not with nominative and accusative plurals. Between the pre- and post-tests the Experimental and Taught Control groups received one 30 minute training session. Both groups worked with the same 10 sentences (e.g., 'The market's fruit stall sells pears'). The sentences were presented orally. The experimental group worked on the meaning, use and different configurations of the apostrophe and spelled down the word with the apostrophe. To do

this they could chose from two cards that displayed a correct (e.g., market's) and an incorrect (e.g., markets) form. The Taught Control group's attention was focused on how the meaning of the sentence would be altered if a homophone replaced one of the words (e.g., 'The market's fruit stall sells pairs'). The Untaught Control group received no intervention.

At pre-test, 9- to 10-year-olds, were found to use a basic phonological approach, not spelling the apostrophe that is a silent morpheme, most of the time. They had not yet been instructed formally about this issue. Older children, already with formal instruction on the apostrophe, used the apostrophe more often but frequently assigned it to the wrong contexts.

At the post-test, they found that the intervention had had a significant effect in the Experimental group, when compared to the other two groups. When year group was controlled for it emerged that older children (years 6 and 7) improved significantly with the intervention. Younger children (year 5), however, showed no signs of improvement across the three training groups.

In order to replicate this study and attempt to clarify why no effects of intervention were found with younger children, a second intervention study was conducted. Another aim of this new study was to evaluate the relation between morphological awareness and the knowledge of how to use apostrophes.

This time, 42 children were involved, in years 5 and 6, in a different school.

The design of the study was the same as before, with just two exceptions. The first consisted of the inclusion of two grammar awareness measures, designed to evaluate

children's explicit awareness of genitive words and their differences from plural words, at pre- and post-test. The second exception was the adding of eight new sentences involving contractions to the set of sentences in the spelling task.

They found that there was a significant increase in the correct use of the apostrophe with year group. Post-test scores were also significantly better than the pre-test scores. Spelling the apostrophe on contractions and plurals was significantly easier than on genitives. The spelling of genitives developed significantly in the Experimental Group as an effect of the intervention. No effects appeared in the control groups.

These findings replicate the previous study showing that a short-term intervention is effective. However, contrary to the first study, the younger children also showed significant improvement with genitives.

As for the role of morphological awareness, they found that Sentence Analogy contributed with unique variance to predict accuracy in the spelling of apostrophes in genitives, even after controlling for differences in age and spelling age.

They concluded that understanding the apostrophe is difficult even for 11-year-old children, but structured interventions can help children to develop such understanding. A second conclusion was that awareness of grammar plays an important role in learning about the distinctions between genitives and other word contexts.

No delayed post-test was used to examine whether the effects of the intervention persisted in the longer term.

Silent morphology is an especially frequent issue in the French language.

Fayol, Thevenin, Jarousse & Totereau (1999) conducted a series of experiments on written French morphology examining how children develop the spelling of silent morphemes that mark the number in nouns, adjectives and verbs.

One of these studies was designed to explore how 6 to 10-year-old children acquired and used the written plural markers in nouns and verbs. The ‘-s’, marking the plural of nouns and the ‘-nt’, marking the third person plural of verbs, are silent morphemes without corresponding pronunciation.

Children performed one comprehension and one written production task. In the first, they had to match written labels with nominal (‘les chiens’- the dogs) and verbal (‘ils sautent’ – they jump) groups, in either the singular or the plural, with pictures depicting what was written on the labels. In the written production task they were required to write a nominal group (‘les chiens’, ‘the dogs’) or a short pronoun-verb sentence (‘ils sautent’, ‘they jump’), given orally, corresponding to what was depicted in a drawing.

They found that the ability to comprehend plural markers preceded the ability to spell them and that nominal plural markers appeared before verb markers.

Three phases were identified in the acquisition of plural markers.

In the first, children just omitted plural markers for nouns and verbs in the spelling, although they showed some awareness of those markers in comprehension tasks.

In the second phase, children showed improved awareness in understanding the meaning of the presence or absence of plural markers in the comprehension task, but continued to find difficult to use those markers in the spelling task.

In the last phase, progressive automation took place in the spelling of accurate plural markers.

They concluded that comprehension and production of plural markers takes several years to be achieved and that the first precedes the second. Plural markers for nouns are perceived earlier than markers for verbs, either because the former are semantically motivated and easier to identify, or because they are supported by an audible difference in the singular ('le', the) and the plural ('les', the) articles. There is no audible difference in the singular ('il', he) and plural ('ils', they) pronouns used with verbs, which makes the plural marker in verbs simply a function of accordance with the subject noun in the sentence. They also propose that automation in the use of plural markers is closely related to children's experience in writing activities.

Previous research (Bock & Eberhard, 1993; Fayol, Largy & Ganier, 1997) had shown that skilled adults tended to produce rare but systematic attraction errors, spelling the plural marker in verbs according to the preverbal number marker, in sentences containing two nominals mismatched for number. An example of this can be found in the sentence 'le chien des voisins arrive' (the neighbours' dog comes) that has the first nominal in the singular ('chien') and the preverbal nominal in the plural ('voisins'). It had been found that adults tend to spell the verb in the plural (arrivent'), a process of attraction by the second nominal.

Fayol et al, (1999) examined whether older and more skilled children would also make these attraction errors. This would be an indication that they are using spelling strategies in a more automatic way, such as adults do.

They hypothesised that younger children would move from systematic unmarking of number agreement to an intermediary phase in which they attempted to enter verb

agreements in their spellings and to a third phase in which, more skilled spellers, would make attraction errors. Children, from the second to the fifth grades, were asked to recall a sentence containing two nominals and a verb in which the nominals were entered in four formats:

1 - Both in the singular (e.g., 'le père de l'enfant chante', meaning 'the child's father sings');

2 - Both in the plural (e.g., 'les roues des wagons bougent', meaning, 'the wagons' wheels move');

3 - The first in the singular and the second in the plural (e.g., 'le chien des voisins arrive', meaning, 'the neighbours' dog comes');

4 - The first in the plural and the second in the singular (e.g., 'les pomes de l'arbre tombent', meaning, 'the apples fall from the tree').

Two spelling conditions were manipulated. In the first (control), children just recalled and spelled the sentences. In the second (experimental), a simultaneous distracting secondary task was introduced, in which children had to recall and spell the sentence, and, at the same time, count clicks or recall a word.

Evidence was again found to support the three-phase process hypothesis. In the first phase, second graders systematically used just the singular form of the verb, in whatever formats of the sentences and in both conditions, showing that they were accommodating a phonological spelling to the pattern of the pronunciation where singular and plural marks are not distinguishable.

In a second phase, a marked influence of either the format of the sentence or the presence of the secondary task, started to appear. Younger children performed worse when the first nominal was a singular and the second a plural. In the distracting condition - the attention resources redirected - younger children were easily disrupted in their subject-verb agreements. They performed worse on sentences where both nominals were in the plural, or the first was a plural and the second a singular. In these contexts, they turned to the simplest type of morphological mark for number, the singular –‘e’ mark. According to the researchers, children are using a conditional-action rule that requires attentional resources. When these are surcharged by secondary tasks, it has a dramatic effect on accurate use of plural markers.

In the third phase, fifth graders were found to perform the expected attraction errors, making the verb agree with the noun that immediately preceded it, in both control and distracting conditions. In the last condition, the number of attraction errors increased. This is similar to the pattern found for adults.

The existence of homophone words that can be either a noun (e.g., ‘timbre’, a stamp) or a verb (e.g., ‘il timbre’, he stamps) in French, led the same researchers to examine overgeneralisations of noun plural markers (‘-s’) to verbs and verb plural markers (‘-nt’) to nouns. They predicted that these overgeneralisations were due to occur only from grade 3 onwards, when children already introduced more than one plural marker to their spelling. The use of overgeneralisations should also be a function of differences in homophone frequency. When the noun homophone was more frequent than the verb, overgeneralisations with ‘-s’ would be more frequent in verbs. Conversely, when the verb

homophone was more frequent than the noun, overgeneralizations with ‘-nt’ would be more frequent when spelling nouns.

Children from the second to the fifth grades (6 to 10 years of age) were asked to write the plural markers for noun words preceded by an article or verbs preceded by a pronoun. For half of the stimuli, nouns and verbs had no homophones (e.g., ‘les nuages / ils mangent’, meaning, the clouds / they eat). For the other half, sentence context determined whether the stimuli were nouns or verbs (e.g., ‘les rêves ... / ils rêvent ...’, meaning, the dreams / they dream).

They found that the number of children that did not use plural markers decreased as grade increased. The proportion of overgeneralisations for nouns (marked with the verb marker ‘-nt’) increased significantly at the end of second and in third grades when children started using this new pattern in their spelling. In grade four, around 20 % of noun spellings were still marked with the verb plural marker but decreased thereafter. The proportion of overgeneralisations for verbs (marked with the noun marker ‘-s’) was very high until the end of second grade and decreased thereafter. Thus, in grade 3, when both markers are already being used, children show a greater percentage of overgeneralisation errors. Then, in grade 4, many nouns continue to be overgeneralised with ‘-nt’ and fewer verbs take the marker for nouns ‘-s’. By grade 5, overgeneralisations are rare. As predicted, a significant effect of homophone frequency was found, from grades 3 to 5, but not before.

They conclude that homophony has no impact on how nouns and verbs are marked before the third grade because children are not still using the two markers in their repertoire.

Thus, it is expected that they have marked 76 % of nouns correctly with ‘-s’, but also used the same marker incorrectly with verbs in 59 % of the cases. When more than one spelling pattern is introduced (around grade 3), difficulties in identifying the syntactic role of the

word lead to spellings that are significantly influenced by frequency effects: if the verb homophone is more frequent, children will more likely overgeneralise nouns with ‘-nt’. If the noun homophone is more frequent, children will more likely overgeneralise verbs with ‘-s’. Eventually, at around grade 5, as the grammar category of words becomes clearer and experience with spelling increases, a systematic assignment will be achieved.

In a following study, Fayol et al. (1999) also examined the development of the use of plural markers in adjectives. This time children had to perform completion and recall tasks in sentences with a ‘determiner-noun-adjective-verb’ format (e.g., ‘les chèvres blanches mangent’, meaning, the white goats eat). In the completion task the child, after hearing the complete sentence, had to supply the plural markers for the noun, adjective and verb, that were missing (e.g., ‘Les chèvre_ blanche_ mange_’). In the recall task, the full sentence was presented orally and the child had to spell the whole set of words, with the exception of the determiner that was already spelled in the answer sheet (e.g., ‘Les. _____ _____ _____’).

The participants were 64 children from the second to the fifth grades.

They found that most of the proportion of errors made in the second grade (86 %) were non-marking errors, i.e., children that did not use any plural mark. This proportion was still high (46 %) in the third grade, and decreased sharply in the later grades. The proportion of non-marking errors was significantly higher in adjectives and verbs than in nouns.

Children also made some overgeneralisation errors marking verb plurals with ‘-s’ and adjective and noun plurals with ‘-nt’. These errors appeared especially in the second and third grades, when children were entering alternative patterns in their spelling.

They concluded that plural markers for nouns, adjectives and verbs are acquired at different moments in development. Noun markers are the first to be achieved and the child probably uses a rule of production – if the article is in the plural, then ‘-s’; this is also aided by phonological distinctiveness of the singular and plural forms of the article. It takes longer to understand plural markers in adjectives and in verbs, whose marker is not semantically determined. In fact, neither the plural pronoun ‘ils’ is acoustically distinguishable from the singular pronoun ‘il’ in verbs nor there is a semantic reason to put an adjective in the plural. The adjective adds some qualitative meaning to the noun but not number meaning. In the example ‘les maisons blanches’ (the white houses) there are several houses but only one white colour. This may explain why it takes several years before children master these complexities.

Fayol et al. (1999) also report an intervention study designed to examine whether first, second and third graders could benefit from the teaching of number morphology. They varied the type of feedback given. Systematic feedback was provided to one group of children. This meant that children received basic tuition about number morphology and made application exercises that their teachers commented and explained in the classroom. In the teaching without feedback group, children received the same basic tuition but their application exercises were given back later, corrected by their teachers, but with no further comments.

They found that there were no effects of socio-cultural variables such as age, gender, father’s and mother’s professional status, nationality and previous nursery experience. The use of plural markers for nouns increased significantly in both instruction groups but only in the first grade. No effects of type of feedback were found for first graders. The use of plural markers with verbs improved in all grades and across both types of instruction.

However, first and second graders were found to improve significantly more in the feedback situation. No differences between type of feedback were found in the third grade. Finally, the use of plural markers in adjectives increased significantly in the feedback group but only in the first grade.

They conclude that structured explicit instruction on verb plurals has an effect on children's use of those markers accurately, from the early grades. These effects are, however, dependent on grade, grammatical status of the words and type of instruction.

Fayol et al. (1999) do not report any relations between spelling and morphological awareness because, as they state, morphology is explicitly taught in French schools.

2.2.3.2 – Summary of main findings

The studies reviewed in this last section dealt with the spelling of silent morphology in the English and French languages. Evidence in both languages illustrates that younger children tend to leave out morphological markers that have no corresponding pronunciation. This is an indication that children use phonological strategies first, spelling only what is pronounced. When they start to consider the need to use different markers, they do not use them respecting their correct grammatical function. Only at a later stage are children able to discriminate those markers systematically.

As Fayol et al (1999) found, lack of discrimination in the spelling of plural markers does not mean that children can not understand their function when they see them on print.

The results found for the spelling of silent morphological markers possess the same trend as those of the longitudinal studies on the use of morphological strategies (Nunes et al, a, b) in the spelling of the '-ed' morpheme, in past regular English verbs. Fayol et al (1999) and Bryant et al (1997) also found positive effects of intervention in the spelling. The use

of intervention studies to confirm causal relations is a needed development, relatively unexplored so far. The use of measures to assess morphological awareness is not common to all studies. Whilst phonological awareness is a clearly established meta-linguistic ability, especially in its relation to reading outcomes, the same is not yet true of morphological awareness. This is probably due to the smaller amount of research on spelling and morphology. Researchers such as Fayol et al (1999) also claim that it is difficult to assess morphological awareness as a meta-linguistic ability because of explicit teaching of morphology in French schools related to the amount of silent morphology that has to be explicitly learned.

2.3 – General summary of the review of the literature

This review of the literature has shown that research on morphological priming identified a specific role of morphemes in facilitating the access to the morphological structure of linguistic stimuli. The setback of these studies is that they do not tell us whether children can advantage from the morphological relations between linguistic stimuli to facilitate their access to the morphemic units of those stimuli. In order to provide first evidence on this, the first study reported in chapter three will examine whether morphological priming is sufficiently powerful to facilitate children's use of morphology when spelling stems in non-transparent derived forms.

Some of the developmental literature suggests that morphological awareness predicts, or is interrelated with, effectiveness in the use of morphology in the spelling. Evidence in the English and Greek languages supports such conclusions. However, with the exception of

Nunes (1998) and Nunes et al.'s (1997, a, b) studies on the English language, none of the remaining evidence is based on longitudinal data. Furthermore, there are no longitudinal studies in the Portuguese language examining the relation between morphological awareness and situations that require morphology in the spelling. Chapters four to seven report a longitudinal study examining consistency in the spelling of stems of base and derived forms, discrimination in the spelling of two homophone suffixes '-esa' and '-eza' and discrimination in the spelling of another pair of homophone suffixes, '-ice' and '-isse'. Spelling stems consistently is a situation where the stems in derived forms flout letter-sound correspondence rules. Despite that, stems are spelled conventionally, according to the spelling of base-forms. Discrimination of homophone suffixes is a situation where the same sound cluster takes alternative spellings based on the grammatical function of the stimulus. Assessing morphological awareness and spelling on different occasions, controlling for the influence of major factors such as differences explained by level of instruction or general intelligence, will allow us to answer the question of whether a specific and predictive relation between morphological awareness and spelling exists in yet another alphabetic language, Portuguese.

Chapter 3

Study 1: Morphological Priming Effects on Children's Spelling

3.1 - RATIONALE

The aim of this study is to establish whether children's spelling of non-transparent derived stimuli can be facilitated by morphological information provided under the form of priming.

A considerable number of experiments on word recognition and lexical decision, with adults, have suggested that the ability to recognise the morphemic structure in words can be facilitated by the use of morphological priming (Emmorey, 1989; Forster & Azuma, 2000; Kempley & Morton, 1982; Laudanna et al., 1989; Laudanna et al., 1997; Laudanna et al., 1992; Raveh and Rueckl, 2000). There is also evidence in developmental studies that children's spelling of stems in morphologically related, based and derived forms, is acquired over time (Aidinis, 1998; Carlisle, 1988; Derwing et al, 1995; Nunes, 1998).

What the literature does not show is whether priming with transparent stems in base forms can facilitate the access to the morphological structure of non-transparent derived forms and thus enhance the use of morphology when children spell the latter forms.

As far as one knows, this is the first time this method has been used in the study of children's spelling processes.

3.1.1 - Consistency in the spelling of stems

In many alphabetic scripts, stems are often spelled consistently in base and derived words despite phonological transformations in the pronunciation. For example, the derived words

‘magician’ and ‘health’ are pronounced differently from the base forms but spelled in the same way: the ending consonant [c] in ‘magic’, pronounced as /k/, changes to the sound /ʃ/ in ‘magician’ and the vowel /ɪ/ in ‘heal’ changes to /ɛ/ in ‘health’.

The spelling of the English derived word ‘magician’ would become unpredictable if no morphological relation with ‘magic’ were available. If the child looks for information about sounds and not about a morphologically related stem, spellings such as ‘magishian’, ‘magition’ or ‘magission’ could be produced. In fact, the sound /ʃ/ can be represented as [sh] in ‘mashed’, as [ti] as in ‘nation’ or as [ss] as in ‘mission’.

European Portuguese, like English, contains examples of phonological changes in the stems that are not marked in the spelling. For example, in the base form ‘tambor’ (the drum) and in the derived form ‘tamborilar’ (to play the drum), the stem vowel [o] (in bold) is spelled consistently although pronounced with a stressed and well articulated /o/ in the former and with a schwa /w/ in the latter. Similarly, the spelling is consistent in ‘receio’ (the fear) and in ‘recrear’ (to fear), despite the [e] (in bold) is pronounced as a stressed and well articulated /e/ in the base and as /ɪ/ in the derived word. The same occurs in ‘martelo’ (the hammer) and ‘martelar’ (to hammer) where the [e] (in bold) is a stressed and well articulated /ɛ/ in the former and is unpronounced in the latter.

If Portuguese children represent the phonology of ‘tamborilar’, ‘recrear’ and ‘martelar’ in the spelling, they would spell the stem vowels as /w/ (‘tamburilar’), as /i/ (‘reciar’) and as /ø/ (‘martlar’), respectively. Thus, spelling these stems in the derived forms consistently with the stems in the base forms is a process related to the representation of morphology as suggested by different researchers such as Nunes (1998), Aidinis (1998), Carlisle (1988) and Smith (1987), reviewed in the previous chapter.

Assessing consistency in the spelling of stems, by adults, would possibly be a too easy a task and most likely would produce ceiling effects. Morphological effects in adults have been examined by measuring latency in visual and auditory word recognition tasks as well as in lexical decision tasks.

It has been found that adults take less time to decide whether a target word is a word in the lexicon or a pseudo-word when the target is preceded by a morphologically related prime (Murrell & Morton, 1974; Kempley & Morton, 1982; Emmorey, 1989; Foster & Azuma, 2000; Raveh & Rueckl, 2000; Laudanna, Badecker & Caramazza, 1989; Grainger, Colé & Segui, 1991). Conversely, the same studies showed that latency times increase when the prime is unrelated to the target, for example 'magician' primed by 'paper'.

According to Drews (1996), in auditory word recognition studies that use morphological priming, *' auditorily or visually presented target words are preceded by spoken primes. In the morphologically related conditions, the primes have morphological properties shared in one way or another with the target words. Priming effects are measured against a baseline condition in which the targets are either presented without primes or preceded by morphologically unrelated primes '* (p.629). Visual primes have been also extensively used in visual word recognition studies (Stolz & Feldman, 1995).

Independently of the model of lexical access, morphological priming studies support the view that stems are basic units of access in morphologically complex words. The inhibitory effects identified by Laudanna et al. (1989, 1992) confirm the importance of stems as basic units of meaning, that are necessarily accessed when stems are homophone but morphologically unrelated. The fact that priming was found effective even when stems have just structural function (Emmorey, 1989) adds strength to the argument. Forster & Azuma (2000) confirmed the possibility that bound stems could be successively used as primes. They also found that priming effects could not be explained by semantic

transparency or orthographic overlap of the bound stems and suggested that such effects are more dependent on stem productivity.

It seems thus conceptually appropriate to ask a new research question, that of whether children will benefit from a facilitating effect of primes that display well articulated and stressed stem vowels, when spelling stems of derived forms with phonological changes of the same stem vowels.

In this study, the hypothesis is that morphological priming with base forms that have stressed and clearly articulated stem vowels will influence the spelling of phonologically changed vowels in the stems of morphologically related derived forms.

Spelling stems that have undergone phonological transformations is complex (Carlisle, 1988; Nunes, 1998) and thus it is expected that positive effects of priming will be weak or even non-existent in the first grades. If, as stated by Emmorey (1989), *'phonological priming may be fragile and have a very short duration'* (p.77), it should be expected that oral primes alone will be less effective than when written primes are added. Older children, in the primed conditions are expected to spell the morphologically marked vowels more accurately than in the non-primed baseline condition. Despite the lack of transparency of the target derived forms, any positive effects of morphological priming, if they are to be specific, should be independent from lexical knowledge. Therefore, one expects to find significant positive effects of morphological priming even when pseudo base-forms are used to prime pseudo derived-forms.

3.2 - PARTICIPANTS

The sample for this study consisted of 854 children from grades 1 to 4, attending three state supported primary schools in the greater Lisbon area. The intake of the schools reflected a high variability in children's background, family education and socio-economic status. The sample represented 47.2% of the target population in the three schools (total = 1809), in the same age range as that included in the study. The data from second, third and fourth graders were collected in the first school term (November / December 1999). In order to control for variability in teacher's methods children from 51 different teachers were included. Because first grade children could not spell low frequency words in the first term, data from this group were gathered in May/June 2000, the third school term. Thus, there is a gap of three months in schooling experience between first and second graders.

Only children born in Portugal, whose first language was Portuguese (European Variant), who spelled every word in the spelling task and who had no stated sensory, cognitive or language impairment, were included.

Children whose spelling task presented repetitions of previously spelled words or variations of a same string of letters unrelated to the required spelling and those who left any of the target words unspelled, were excluded (n=47). This occurred mainly in the first school grades decreasing thereafter (21, 18, 5 and 3 children respectively in grades 1, 2, 3 and 4). Two (2) children who were then referred for Special Needs support, were also excluded.

Thus, 49 children were excluded. In this study, then, results from 805 children are reported, from grades 1 (n=101), 2 (n=215), 3 (n=207) and 4 (n=282). Mean age was 83.6, 88.8, 102.2 and 115.2 months for first, second, third and fourth graders, respectively (standard deviations of 4.6, 3.8, 6.7 and 7.8 months, respectively).

The participants details are summarised in Table 3.1.

Table 3.1 – Mean Age and Standard Deviations (in months) of participants, by Grade

Grade Level	Mean	SD	N
First	83.6	4.6	101
Second	88.8	3.8	215
Third	102.2	6.7	207
Fourth	115.2	7.8	282

The socio-economic status of the children’s families (SES) was assessed comparing those receiving and those not receiving economical support from the educational authorities.

This support includes free meals, schoolbooks and stationary expenses and is a function of the 'per capita' income, as stated by the family. In this sample, 20.9% (n=168) of the children were receiving support, the remaining 79.1% (n=637) were not.

Gender was distributed as follows: 51.6% were boys (n = 415) and 48.4% were girls (n = 390).

Head-teachers in three schools were contacted and one informal meeting was held in each school to explain the broad general aims and the procedures involved.

Each one of the three School Councils, where teachers are represented, decided that parents’ permission was not required because the activities in which children were going to be involved – performing a spelling task - did not differ from normal instructional activities.

Because the spelling task was performed in the classroom, all children participated in it independently of the criteria of inclusion previously set for the study. Children who were excluded on these criteria were not aware of it. Teachers were only informed of the criteria of inclusion at the end of the data collection in meetings held in each school where first results were outlined and discussed.

3.3 - DESIGN

The children in the three schools were randomly allocated, as classroom groups, to one of six different spelling conditions. These conditions resulted from a 3 x 2 design in which the spelling task was performed under one out of three different Levels of Morphological Priming (1 = no priming, 2 = oral priming, 3 = oral plus written priming) and under one out of two different Levels of Lexical Information [1= absent (pseudo-words) and 2 = present (words)]. Children in grades 1 to 4 were included in each spelling condition.

Table 3.2 displays the design of the six spelling conditions and their relations with the level of morphological priming that was provided and with the level of lexical information that was available.

Table 3.2: Design of the Study

Level of Morphological Priming			
	No Priming	Oral priming	Oral plus written priming
Lexical Information Absent (Pseudo-words)	Spelling condition 1	Spelling condition 2	Spelling condition 3
	24 pseudo-derived stimuli are spelled in the context of orally presented sentences not containing the pseudo-base form	24 pseudo-derived stimuli are spelled in the context of orally presented sentences that contain the pseudo-base form	24 pseudo-derived stimuli are spelled in the context of orally presented sentences that contain the pseudo-base form, the sentence also being given in written format.
	(N = 147)	(N = 131)	(N = 131)
Lexical Information Present (Words)	Spelling condition 4	Spelling condition 5	Spelling condition 6
	24 derived words are spelled in the context of orally presented sentences not containing the base word	24 derived words are spelled in the context of orally presented sentences that contain the base word	24 derived words are spelled in the context of orally presented sentences that contain the base word, the sentence also being given in written format.
	(N = 132)	(N = 133)	(N = 131)

Note: Children in grades 1 to 4 in each spelling condition

Accurate morphological spellings in a baseline non-primed condition are compared with two primed conditions in which oral primes alone or oral primes added to written primes are used. Morphological priming studies with adults, usually use reaction times and error rates as the main dependent variables. It was considered in this study that reaction times

could not account reasonably for the processes involved in children's spelling because the focus was on accurate morphological spelling of the vowels that are morphologically marked and not on speed of recognition of derived words.

Previous lexical rote learning effects are controlled for by varying lexical information that is present in words and absent in pseudo-words. Doing so, we want to make sure that any priming effects are not just a by-product of lexical information. Priming effects should as well occur when pseudo-words are spelled.

Using only low frequency words controls for word frequency effects. These, place the highest demand on children's spelling strategies, again providing a more stringent control for the influence of previous lexical knowledge. It has been found that high-frequency primes are not appropriate stimuli. On the contrary, the higher the frequency the lower the priming (Bowers, 2000). Giraudo & Grainger (2000) also came to the same conclusion. They found that *“high frequency orthographically related primes tend to produce interference (rather than facilitation) in target word processing”* (p.429).

3.4 – MATERIALS and PROCEDURE

The spelling task consisted of 24 prime – target, base / derived, pairs that shared the same stem, e.g. ‘martelo’ – ‘martelar’ (the hammer - to hammer). The same number of pairs was generated with pseudo-base / pseudo-derived stimuli, e.g. ‘barfelo’ – ‘barfelar’. These stimuli had the same vowel structure as the corresponding words, the same or other nasal vowels, digraphs substituted by other digraphs and consonant/vowel clusters where special contextual rules applied substituted by other clusters following a similar rule (e.g., g + e/i

substituted by c + e/i). The grammar category of words was kept on the pseudo-base / pseudo-derived stimuli.

Base and derived word pairs were chosen from low-frequency words. Because no frequency counts, suitable to the study of spelling in children, existed for European Portuguese, it was necessary to develop a Corpus of Word Frequency.

This corpus is based on frequency counts from printed words in a sample of school reading books used in the teaching of reading and spelling in Portuguese primary schools, from the first to the fourth grades. In order to obtain this corpus, 85310 words (token) of text and application exercises were entered for frequency analyses, by the experimenter. A list of 7816 different words (type), classified for frequency, emerged. Only stimuli appearing 4 times or less, in this Corpus of Word Frequency were used.

The spelling task consisted of three categories of words. Each category contained 8 words. In the first category, the prime has a stressed [o] that is kept in the spelling of the derived word, although unstressed and pronounced as /w/. Example: ‘negócio – negociante’, which sound as /n'gɔsiw/ - /ngwsi'ãt/ (business – businessperson).

In the second category, the prime has a stressed [e] that is kept in the spelling of the derived word although unstressed and pronounced as /ɨ/. Example: ‘ceia – cear’, which sound as /'seia/ - /si'ar/, (the supper – to have supper).

In the third category, the prime has a stressed [e] that is also kept in the derived-word although unstressed and unpronounced in the colloquial use of the language. Example: ‘martelo – martelar’, which sound as /mər'telw/ - /mər'tlar/, (the hammer – to hammer).

The sentences with the three categories of words (and pseudo-words) are listed in Appendix 3.1.

The spelling task was collectively administered in the classroom. The three word categories were entered in the context of sentences, randomly mixed in the list, all children spelling them in the same order. Children in the baseline and oral priming conditions (spelling conditions 1, 2, 4 and 5 as shown in Table 3.2) had an answer sheet consisting of a numbered table with blank spaces. Children in the oral plus written priming conditions (spelling conditions 3 and 6 as shown in Table 3.2) received an answer sheet where the sentences were written down. A blank space in those sentences indicated the place where the target word had to be spelled. No mark existed to highlight the prime, e.g., it was not underlined or bold. There were 15 sentences in each page, written in lower case font size 16.

The children received an answer sheet and the following oral instruction: *'I am going to read a sentence to you. I will repeat one word in that sentence. The word that I say twice is the one you are going to write down'*. Children spelling pseudo-words were further told that *'they were going to spell words invented by the experimenter'*. No reference was made to the presence of the prime in the primed conditions. A colloquial pattern of the language was used, when presenting the sentences.

Sentences were supplied according to the children's pace, and the experimenter ensured that each child attempted all words, as far as possible. Teachers were asked not to provide any spelling information to the children.

Table 3.3 displays one example of a sentence in each of the spelling conditions.

Table 3.3: One Example of the Spelling Task in Each One of the Six Spelling Conditions

Level of Morphological Priming			
	None	Oral priming	Oral plus written priming
	Spelling condition 1	Spelling condition 2	Spelling condition 3
Lexical Information Absent (Pseudo-words)	Ex: Ele está a tocar pandeireta; ele está a candorilar [He plays the tambourine; he is (candorilar)]	Ex: Ele está a fazer candor ; ele está a candorilar [He is doing (candor) ; he is (candorilar)]	Ex: Ele está a fazer candor ; ele está a candorilar [He is doing (candor) ; he is (candorilar)]
	Spelling condition 4	Spelling condition 5	Spelling condition 6
Lexical Information Present (Words)	Ex: Ele está a tocar pandeireta; ele está a tamborilar [(He plays the tambourine; he is (drumming))]	Ex: Ele está a tocar tambor ; ele está a tamborilar . [He is playing the drum ; he is (drumming)]	Ex: Ele está a tocar tambor ; ele está a tamborilar [He is playing the drum ; he is (drumming)]

Note: In the examples above ‘candor’ is the pseudo-base prime and ‘candorilar’ is the pseudo-derived target. Similarly, the base word ‘tambor’ is the prime and the derived-word ‘tamborilar’ is the target. Primes and targets are in bold.

The derived words and the pseudo-derived stimuli were scored as correct (1) or incorrect (0) depending on whether they presented or not the morphologically marked vowel in the target word. Orthographic errors outside the vowel were not considered because other spelling rules might apply and these were not being investigated.

3.5 - RESULTS

3.5.1 – Analyses of reliability and skewness

A highly reliable Cronbach's Alpha for item analysis was found for correct answers in the spelling task (Alpha = .82). Closer attention was given to the variances and item total correlations explained by each item. Each word in the three categories in the spelling task performed well. The removal of any word proved unnecessary because all alphas if item deleted remained within the .81 to .82. range.

The analysis of the distribution of the scores in the spelling task showed that those were normally distributed. The analysis of the significance of Skewness ($p = 0.05$) showed that the scores were not significantly skewed (Skewness = 0.147; Standard error of skewness = 0.086; $z = 1.70$).

3.5.2 – Analysis of the means and standard deviations

Table 3.4 displays the means and standard deviations for correct spelling, by Level of Morphological Priming, Level of Lexical Information and Grade.

Table 3.4: Means and Standard Deviations (in brackets) of Correct Spelling of Vowels in derived words and pseudo-words by Level of Morphological Priming, Level of Lexical Information and Grade.

Level of Lexical Information	Grade		Level of morphological priming		
			No- priming	Oral priming	Oral plus written priming
			Spelling Condition 1	Spelling Condition 2	Spelling Condition 3
Absent (Pseudo-words)	1	M	10.89	8.93	10.43
		(SD)	(3.09)	(3.58)	(2.06)
		N	19	15	14
	2	M	10.63	10.82	11.59
		(SD)	(3.87)	(3.23)	(3.42)
		N	38	38	29
	3	M	10.23	10.37	14.73
		(SD)	(2.67)	(3.38)	(3.60)
		N	40	35	30
	4	M	9.52	13.23	15.98
		(SD)	(2.85)	(3.66)	(3.80)
		N	50	43	58
			Spelling Condition 4	Spelling Condition 5	Spelling Condition 6
Present (Words)	1	M	10.39	11.00	11.11
		(SD)	(3.11)	(2.90)	(3.97)
		N	18	16	19
	2	M	12.24	11.95	11.54
		(SD)	(2.81)	(2.97)	(3.92)
		N	33	38	39
	3	M	12.61	14.84	15.94
		(SD)	(4.68)	(3.82)	(3.55)
		N	33	38	31
	4	M	14.67	16.27	17.33
		(SD)	(3.77)	(4.52)	(3.43)
		N	48	41	42

Note: Minimum = 0; Maximum = 24.

Preliminary analyses showed that there were no significant differences as a function of School (3 different schools), Gender, and SES (state supported or not). These variables were removed from further analyses.

3.5.3 – Analyses of significance of the mean differences

In order to test the overall effects of the main terms on correct morphological spelling, analyses of variance (ANOVA) by subjects and by items were computed. The dependent variable was correct spelling of morphologically marked vowels and the main terms were Level of Morphological Priming (3: No-priming; oral priming; oral plus written priming), Level of Lexical Information (2: absent in pseudo-words; present in words) and Grade (4: grades 1, 2, 3, and 4).

In the by-subjects analysis, the Level of Morphological Priming term was significant ($F(2, 781) = 22.36, p < 0.001$): Post-hoc Student-Newman-Keuls tests ($\alpha = 0.05$) showed that accurate spelling was significantly lower in the non-primed condition than in the primed conditions. Performance in the oral-primed condition was also significantly lower than in the oral plus written priming condition. The same trend emerged when variance in accurate spelling of items was compared in the three conditions of priming ($F(2, 23) = 25.86, p < 0.001$). Pairwise comparisons (Least Significant Differences, $\alpha = 0.05$) also confirmed that correct spelling of items was significantly different in the three conditions of priming (no-priming < oral priming < oral plus written priming).

The Level of Lexical Information term was also significant ($F(1, 781) = 48.20, p < 0.001$). T-tests for independent samples showed that pseudo-words were significantly less accurately spelled than words ($t(803) = -6.78, p < 0.001$). Further independent samples t-tests revealed that words were significantly better spelled than pseudo-words in the no-priming ($t(277) = -6.53, p < 0.001$), and oral priming conditions ($t(262) = -5.55, p <$

0.001) but not in the oral plus written priming conditions ($t(260) = -.46, p = 0.648, n.s.$). T-tests for paired samples comparing accurate spelling in pseudo-words' items and in words' items ($t(23) = -3.11, p = 0.005$) also showed that those items where lexical information existed (words) were significantly better spelled than those where spelling performance could not be based on semantic or visual information (pseudo-words).

In the by-subjects analysis, the Grade term was also significant ($F_1(3, 781) = 46.40, p < 0.001$). Subsequent Post-hoc Student-Newman-Keuls tests ($\alpha = 0.05$) showed that children in grades 1 and 2 were not significantly different in the level of correct spelling but differed from grade 3, which in turn differed from grade 4. A slight different pattern emerged in the by-items analysis. As before an overall effect of grade was found ($F_2(1, 23) = 140.62, p < 0.001$) but pairwise comparisons (LSD; $\alpha = 0.05$) showed that all grades were significantly different. The latter result may reflect a linear effect of instruction in the spelling of each item.

The by-subjects analysis also produced Grade by Level of Morphological Priming interactions, in the spelling of pseudo-words ($F_1(6, 397) = 8.48, p < 0.001$) and words ($F_1(6, 384) = 2.14, p < 0.05$).

Figure 3.1 displays that interaction for the spelling of Words and figure 3.2 presents the interaction for the spelling of pseudo-words.

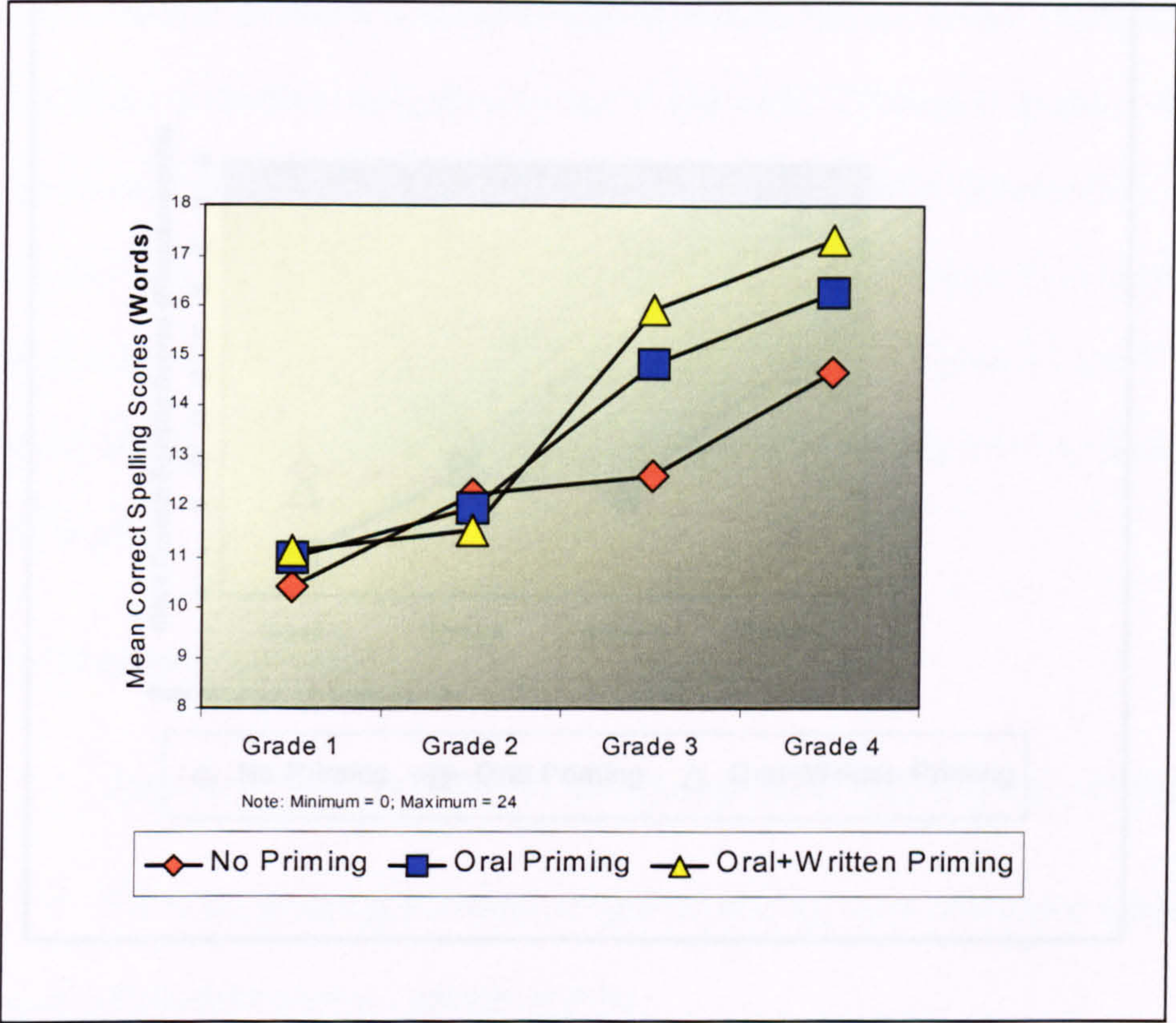


Figure 3.1 – Interaction between Morphological Priming and Grade, in the spelling of Words

As shown in Figure 3.1, the interaction is due to a significant better performance in the oral priming and oral plus written priming conditions of children in Grades 3 and 4, when compared to the no-priming condition. No significant differences emerged in the first two grades.

In the next figure, the interaction between morphological priming and grade is displayed for the spelling of pseudo-words.

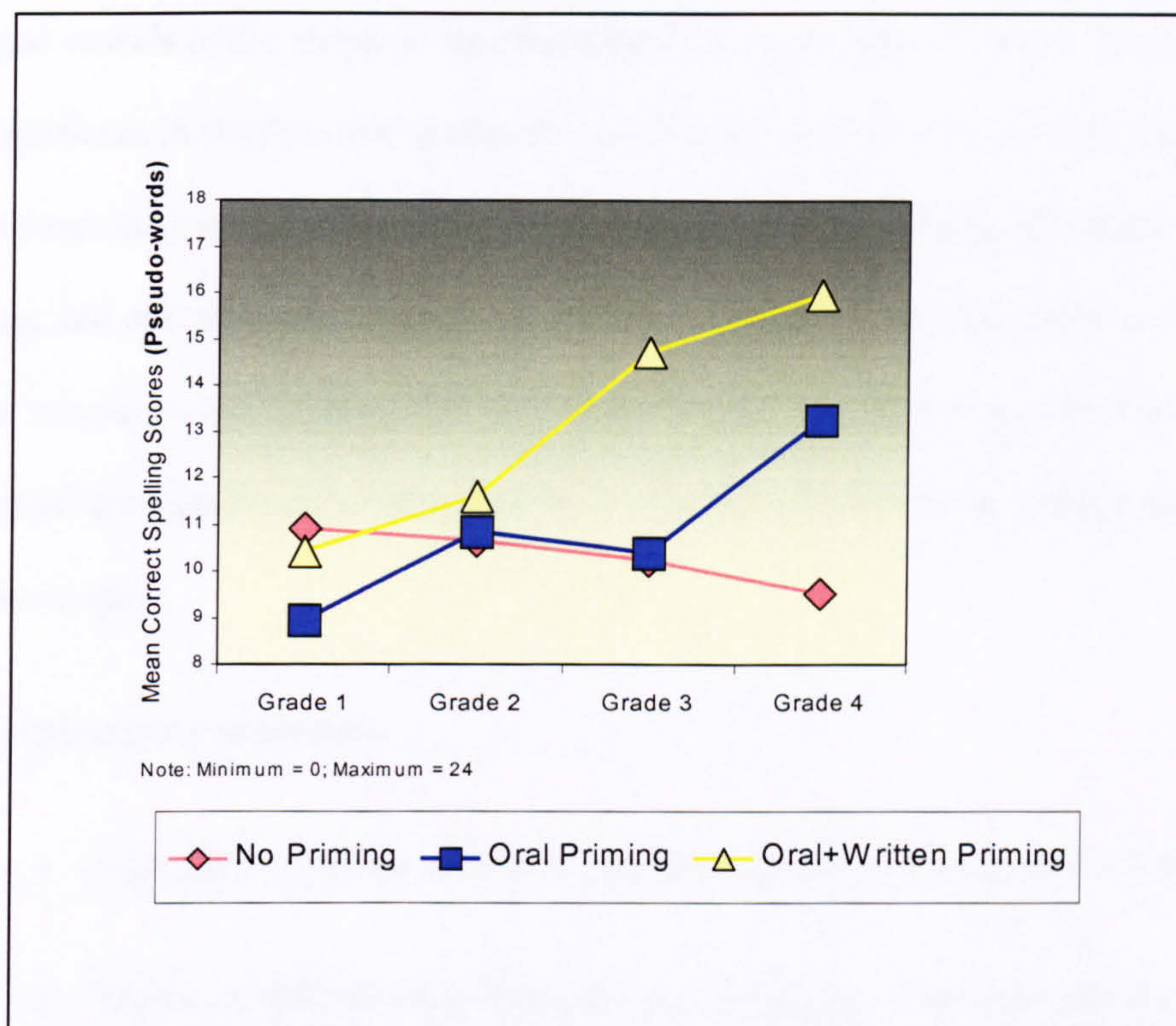


Figure 3.2 - Interaction between Morphological Priming and Grade, in the spelling of Pseudo-words.

Figure 3.2 shows that the interaction is due to significant differences in the oral plus written priming condition in Grades 3 and 4 and in the oral priming condition in Grade 4, when compared to the no-priming condition. No significant differences emerged in Grades 1 and 2 and in Grade 3 in the oral priming condition.

In order to control for any differences due to word category, separate by-subjects analyses of variance were also performed for each one of the three categories of words in the spelling task. The same trends as those reported above were found.

The results strongly support the hypothesis that morphological priming with base forms that have stressed and clearly articulated vowels influence the spelling of phonologically changed vowels in the stems of morphologically related derived forms. This influence is not significant in the first two grades (6- and 7-year-olds). Children in grades 3 and 4 (8- and 9-year-olds) have their spelling of derived words significantly influenced by both oral priming and oral plus written priming. Children in grade 4 (9-year-olds) do take advantage of oral priming when spelling derived pseudo-words. Children in grades 3 and 4 (8- and 9-year-olds) are significantly influenced by oral plus written priming when spelling derived pseudo-words.

3.5.4 – Summary of results:

- 1 – Significant positive effects of morphological priming appear in Grades 3 and 4.
- 2 – There are differential effects of type of priming when considered against level of lexical information (words / pseudo-words):
 - when oral primes are provided alone, significant effects appear in the spelling of derived words (grades 3 and 4) and derived pseudo-words (grade 4).
 - When oral plus written primes are provided significant effects appear both in the spelling of derived words and derived pseudo-words (grades 3 and 4).
- 3 – Morphological priming effects are not dependent on lexical information because significant effects also appear in the spelling of pseudo-words.

3.6 – DISCUSSION AND CONCLUSIONS

This study provides first evidence that morphological priming can be an interesting conceptual and educational tool to enhance children's spelling of phonologically opaque vowels in derived words. Developmental studies on stem morphology showed that the processes involved are far from being simple. In children from 6 to 10 years of age, those processes are dependent on spelling knowledge and morphological awareness and follow a developmental trend (Nunes, 1998; Aidinis, 1998). Studies with children from the fourth to the eighth grade showed that this development was dependent on the complexity and degree of transparency of the phonological or orthographic transformations involved (Carlisle, 1988; Leong, 2000; Derwing et al., 1995).

The evidence provided in this study suggests that morphological priming can effectively be used with children, and that, in itself, is quite challenging.

Priming was effective in later grades, despite the fact that the derived words had phonological changes, quite difficult for children. Those changes involve listening to distinctively different sounds or having to represent sounds that are suppressed in the pronunciation. Priming was also effective despite the fact that primes were entered in sentences, thus separated by a number of intervening items from their targets. There is evidence from adult studies that strong priming effects can still be found even when primes and targets sharing the same morpheme, are separated by up to 50 intervening items (Stoltz & Feldman, 1995) but it is unknown how this affects children's spelling. Sentence context is necessary for children's comprehension and to make the tasks meaningful. However, especially with oral priming, sentence noise may eventually accentuate the 'fragility' of orally presented primes, to use Emmorey's (1989) term. Oral primes, although brief auditory stimuli, were nevertheless effective after the third grade (words). Oral plus written

primes provided a more permanent link to the morphological relation between stems. Older children can use such relation in the presence of oral primes in the third grade (words) and both oral and oral plus written primes are effectively used, in the fourth grade, to spell both words and pseudo-words. Older children again, can not, as effectively, infer such morphological relation in the non-priming condition.

It is thus possible that older children can access morphological information from primes, in the absence of any specific instruction about the morphological relations of the linguistic stimuli involved. It may be that such access is beyond awareness that the stems in derived forms are morphologically marked by the stems in base forms. Children may not be able to verbalise such relation explicitly. Nonetheless, older children access this relation more effectively when primed.

This raises interesting educational implications. In Portuguese primary schools, the spelling of non-transparent derived forms is approached as if each word was an exception to be stored in memory. In order to achieve that, children systematically undergo the spelling of lists of, so called, difficult words, especially those that they have failed in exercises of copying and dictation. When teachers dictate words, they usually distort the pattern used in the colloquial pronunciation in order to adapt it to the spelling requirements. By doing so, children are once more encouraged to store a double pattern, one for the pronunciation and another for the spelling.

This study suggests that, at least older children have the potential, probably underestimated, to use a morphological approach. Such approach, because based on highly productive principles, i.e., stems are usually spelled consistently in base and derived words, reduces the need to store words as individual lexical entries and provides children with tools that can be used for categories of words that follow a specific morphological principle, thus productively. A more systematic morphological approach, prompting the

children to systematically ask one of Smith's (1987) questions - 'does this word comes from any other word I can think of?' – has many advantages. It would allow them to work with the colloquial pattern of the language, the one they know best and where a distinct articulation for the stressed vowels in the base words is transparently available.

Further studies are needed to provide a sound empirical basis for the effectiveness of priming and for the reasonability of these educational implications. Intervention studies comparing the differential effects of teachers' usual approaches with instructional interventions with a stronger morphological rationale are needed. The assessment of short and long-term effects of both procedures is also necessary.

To conclude, this study provides new evidence that morphological priming can be successively used to enhance the spelling of morphologically marked vowels in stems of derived words with phonological transformations, in Portuguese (European Variant), by children in grades 3 and 4 (8 and 9 years old, respectively). It is proposed that instructional approaches based on a closer consideration of morphological principles will be more effective than taking morphologically determined words as individual spelling exceptions to be stored in memory.

Priming morphological relations may help children to develop unexplored abilities, to build a new framework for thinking about morphological relations in the spelling that can be used productively for further learning.

Chapter 4

Study 2 - Morphological Awareness and the Development of Morphologically Based Spellings

4.1 – RATIONALE

The main aim of this longitudinal study is to examine the hypothesis that there is a predictive relation between morphological awareness and the development of morphologically based spellings.

The secondary aim is to describe the spelling and morphological awareness measures that were developed, their internal consistency, their sensitiveness to capture developmental trends, their concurrent relations and predictive value. This is done because no suitable measures to assess morphological awareness and spelling knowledge were available in Portuguese, when the study started.

In order to answer those two aims this chapter analyses the concurrent relations in the first Session of a longitudinal study.

Some spellings are morphologically based when they are determined by the way morphemes are represented and not by their phonological characteristics (Bryant et al., 1999). In these situations, there is a conflict between the representation of phonology and the representation of morphology.

The focus of the study is the relation between morphological awareness and two kinds of morphologically based spellings that pose such conflict in Portuguese: firstly, consistency in the spelling of stems; secondly, discrimination in the spelling of words and pseudo-words that end in homophone suffixes.

4.1.1 – Morphological awareness and consistency in the spelling of stems

Spelling stems consistently enters the first category of situations where spelling is determined by morphology (Bryant et al. 1999), i.e., the conventional spelling of morphemes that flout letter-sound correspondence rules.

In Portuguese, as in many alphabetic languages, words that are morphologically related have their stems spelled consistently even when there are differences in their pronunciation.

In the previous study children were provided with primes - stems of base forms whose spelling is phonologically transparent (e.g., ‘tambor’, the drum) - and asked to spell the same stems in target derived forms where the spelling is not transparent (e.g., ‘tamborilar’, to drum).

The study suggested that 8- and 9-year-old children are able to advantage of the morphological information represented in the prime despite the fact that no information was provided about its relevance. The prime facilitated the access to the morphological structure of the target despite differences in the pronunciation of the stems in the prime and in the target. This ability enhanced their accuracy in spelling stems in derived words consistently. However, morphological awareness was not specifically assessed, and therefore no answer was provided as to whether consistency in the spelling of stems is dependent on morphological awareness.

In the present study, children are assessed on their abilities to reason about morphological relations presented in words and sentences, and on accuracy to spell stems consistently in base and the derived forms, without priming. This enables us to understand whether there is a link between the two abilities.

Research in different languages has suggested that such a link exists. Nunes (2002), for example, conducted a longitudinal study with English children on how they spelled base words and derived pseudo-words that had the same stem. The stems in both stimuli contained silent letters or digraphs (e.g., the ‘r’ in *iron* or the ‘k’ in *knot*). The ‘derived’ pseudo-words were formed by adding the suffix ‘saurus’ to the stems (e.g., *ironsaurus*), in combinations that do not exist in the English language. Children’s awareness of morphology at an earlier age was found to significantly predict their adoption of consistency in the spelling of stems at a later age. Conversely, children’s knowledge about consistency in the spelling of stems at an earlier age also predicted their awareness of morphology at a later age. Thus, morphological awareness and consistency in spelling stems were interrelated and predicted each other.

Aidinis (1998) used similar tasks in a cross-sectional study with Greek children. He also found an association between morphological awareness and consistency in the spelling of stems. Carlisle (1988) also examined how knowledge of derivational morphology was related to consistency in spelling stems in base and derived forms in a cross-sectional study with English-speaking children. A close association between awareness of derivational morphology and consistency in spelling stems in base and derived forms was found, mediated by the complexity of the transformations that were involved.

There are no studies in Portuguese that examine how morphological awareness develops, how consistency in the spelling of stems improves, and whether a predictive relation between the two exists. The present study attempts to provide first evidence on these issues.

4.1.2 – Morphological awareness and discrimination of words and pseudo-words ending in homophone suffixes

Discrimination of words and pseudo-words ending in homophone suffixes enters the second category of situations where spelling is determined by morphology (Bryant et al. 1999), i.e., when more than one spelling alternative exists for the same sound.

Homophone suffixes have the same pronunciation but different spellings. The spellings are determined by what meaning is added to the stem by the suffix. Here, two cases are analysed. Firstly, the suffixes, ‘-esa’ / ‘-eza’. Secondly, the suffixes ‘-ice’ / ‘-isse’.

In the first pair, ‘-esa’ forms feminine nouns with a meaning of belonging to or provenance from an ethnic group or a class (e.g., ‘camponesa’- a rural worker) and ‘-eza’ forms abstract nouns conveying a meaning of conceptual abstraction to a noun or adjective (e.g., ‘beleza’- beauty). In the second pair, ‘-ice’ adds an abstract meaning to a noun or adjective (e.g., ‘chatice’ – boredom) and ‘-isse’ adds a verb meaning for the subjunctive (‘partisse’ – if I ran away).

Learning which spelling to use requires a progressive understanding that these different meanings are conveyed by different suffixes despite the impossibility of distinguishing them on a phonological basis.

There is some evidence in Portuguese (Brazilian Variant) that children take time to understand these distinctions. Nunes (1992) showed that children took up to the eighth grade to master the spelling of ending diphthongs that are homophone, but the relation between spelling accuracy and morphological awareness was not examined. Da Mota (1995) found significant correlations between the spelling of the homophone suffixes ‘-esa’/ ‘-eza’ and morphological awareness. However, she used a spelling task with just three items of each

kind of suffix and did not control for lexical knowledge. In addition, the significant results between morphological awareness and spelling did not hold after controls for Grade differences. Thus, it cannot be concluded from this study that there is a specific relation between morphological awareness and spelling of homophone suffixes because both variables can be related to a third factor.

Research is needed on how morphological awareness influences the spelling of words with homophone suffixes, with stronger controls for the effects of other more general factors such as Grade and IQ. This is necessary to claim a specific relation between morphological awareness and spelling.

Three hypotheses are tested in this study:

Hypothesis 1 – Morphological awareness is an ability that improves significantly with grade.

It is expected that the two measures of morphological awareness are strongly interrelated, measure a specific ability independently of effects explained by more general factors such as Grade and IQ, and are sensitive to capture a trend that is likely to occur in children's development.

Hypothesis 2 – Consistency in the spelling of stems and discrimination of homophone suffixes improve significantly with grade.

It is also expected that children will improve consistency in the spelling of stems and discrimination in the spelling of words and pseudo-words ending in homophone suffixes as Grade increases, after controlling for IQ differences.

Hypothesis 3 – There is a predictive relation between morphological awareness and accuracy in morphologically based spellings (consistency in the spelling of stems and discrimination in the spelling of words and pseudo-words ending in homophone suffixes), which cannot be explained by the fact that the two relate to a third factor.

It is expected that measures of morphological awareness will predict the scores of consistency in the spelling of stems and of discrimination in the spelling of homophone suffixes, after controlling for shared variance explained by general factors such as differences in instruction (Grade) and in general intelligence (I.Q.).

4.2 – PARTICIPANTS

There were 184 children in the study, from 2 state-supported primary schools, in the greater Lisbon area, in Portugal. Participants were randomly selected from the school register by the experimenter. The average number of children in each classroom was around 25 but no more than 10 children from each classroom were included.

All children had European Portuguese as their first language and no diagnosed sensory or cognitive impairments. The sample covered a wide range of socio-economic backgrounds.

When the first session of the data collection took place (May 2001) children were at the end of the last term in Grades 1, 2 and 3.

Table 4.1 displays the means and standard deviations (in brackets) for the ages of the participants.

TABLE 4.1: Mean age and Standard Deviations (in brackets) and age range in months, of participants, by Grade

	Age M (SD)	Age Range		N
		Min.	Max.	
Grade 1	83.31 (3.71)	76.00	89.00	64
Grade 2	95.72 (3.18)	98.00	100.00	61
Grade 3	107.31 (3.64)	95.00	113.00	59

4.3 – DESIGN

A longitudinal design is used with morphological awareness measures as predictors, measures of morphologically based spellings as outcome variables and Grade and IQ as covariates.

The two morphological awareness measures, or predictors, are Word Analogy and Sentence Analogy. Word Analogy examines whether the child can recognise the morphological relation between two words that are provided first (e.g., *teacher – taught*), and use reasoning by analogy to account for a similar morphological transformation when a third word is provided (e.g., *writer - ____?*). Sentence Analogy has the same rationale, but the stimuli consist of sentences instead of single words.

The morphologically based spellings, or outcome variables, were assessed by a spelling task.

The stimuli in this task assessed:

1 - Consistency in the spelling of stems:

1.1 – Base / Derived Words

1.2 - Base / Pseudo-derived stimuli

2 - Discrimination in the spelling of homophone suffixes:

2.1 - ‘-esa’ / ‘-eza’ words

2.2 – ‘-esa’ / ‘-eza’ pseudo-words

2.3 - ‘-ice’ / ‘-isse’ words

2.4 – ‘-ice’ / ‘-isse’ pseudo-words.

Spelling stems consistently and the discrimination of homophone suffixes can be achieved in two possible ways. Either the child is aware of the morphological rationale of the words or has learned the words before, through his or her experience in reading and spelling. To control for lexical effects pseudo-words were also presented. Accurate spelling of non-transparent stems in pseudo-derived stimuli is the clearest indication that the child followed a morphological route. Similarly, spelling homophone suffixes in pseudo-words according to the grammatical status of the stimuli is only possible through morphology.

Finally, children were assessed for IQ in order to ascertain that the differences in this control factor were not explaining most of the variance in the relations between morphological awareness and consistency or discrimination in morphologically based spellings. Differences in level of school instruction (Grade) were also controlled for in order to exclude that any specific relations were simply an expectable effect of instruction. Because Age and Grade are confounded, Grade is entered in all the statistical analyses.

4.4 – MATERIALS and PROCEDURE

4.4.1 - The morphological awareness tasks

Children were seen individually and assessed with two tasks of morphological awareness, the Word Analogy (WA) and Sentence Analogy tasks (SA). These tasks were adapted from tasks created by Nunes et al., (1997 a, b; Nunes, 1998), and used in studies with English children. Because no measures were available in European Portuguese, they were designed according to the principles used to design the English tasks.

According to Nunes et al., (1997, a) the aim of the Word Analogy and Sentence Analogy tasks *“was to measure awareness of the distinctions between different parts of speech and of the relation between present and past-verbs. (...) Our concern was with children’s explicit understanding of the relation between present and past verbs whether the past form was regular or not”* (p. 639). On another study they state that the aim of the Word Analogy task *“was to measure how aware the children were of the analogies between words of the same grammatical categories irrespective of whether they shared or not a derivational or inflectional morpheme”* (Nunes et al., 1997, b). These tasks were constructed according to an analogy paradigm, a:b::c:d, used in cognitive psychology research (Piaget, Montangero & Billeter, 1977; Sternberg, 1977).

Table 4.2 displays the items of the Word Analogy Task and Table 4.3 presents the items of the Sentence Analogy Task. The tables contain the items, which morphological transformations were required in each item, and a translation into English to facilitate the analysis by the reader.

The words or sentences in bold refer to accurate answers that children were expected to give.

Table 4.2: The Word Analogy task (WA)

	Word Analogy Items	Main Transformations Required	Translation
PT	Duque – duquesa; Príncipe – princesa;	Irregular masculine to feminine	Duke – duchess; Prince – princess;
1	Trabalhar /trabalhador; Pintar /Pintor;	Verb to noun + transformation in the suffix (trabalhador-pintor)	To work / worker; To paint / painter;
2	Belo /beleza; Pobre / pobreza;	Adjective to abstract noun	Beautiful / beauty; Poor / poverty;
3	Andar /andou; Tremar /Tremeu;	Verb infinitive to past + change in the verb thematic vowel (andar – tremar)	To walk / walked; To tremble / trembled;
4	Director /dirigiu; Escritor /Escreveu	Noun to verb in the past + change in the verb thematic vowel (dirigiu – escreveu)	Director/ directed; Writer/ wrote;
5	Dançar /dançava; Ver / Via;	Verb infinitive to present perfect + regular to irregular + change in the verb thematic vowel (dançar – ver)	To dance/ he was dancing; To see / he was seeing;
6	Serra / serrote; Caixa / Caixote;	Noun to noun augmentative	Saw / big saw; Box / big box;
7	Surdo /ensurdecir; Manhã / Amanhecer;	Noun to verb infinitive + adding both the prefix and the suffix (ensurdecir – amanhecer) + different prefixes	Deaf / to deafen; Dawn / to dawn;
8	Cantar /canção; Viver / Vida;	Verb infinitive to noun + change in the thematic vowel of verbs, cantar - viver	To sing / song; To live / life;
9	Fingir / fingisse; Explodir / explodisse;	Verb in the infinitive to verb in the subjunctive	To pretend / if he had pretended; To explode / if it had exploded;
10	Crença / credence; Guloso / gulodice or gulosice;	Noun to abstract noun with both phonological and orthographic changes in the derived word's stem	Belief / superstition Greedy / greed

Table 4.3: The Sentence Analogy task

	Sentence Analogy Items	Main Transformations Required	Translation
PT	Eu entro na escola / Eu entrei na escola; Eu escrevo no caderno / Eu escrevi no caderno;	Present to past + change in the verb thematic vowel (entrar – escrever)	I enter school / I entered school; I write in my notepad / I wrote in my notepad;
1	O menino brinca muito / Os meninos brincam muito; O menino corre muito / Os meninos correm muito;	Sentence in the singular to sentence in the plural	The boy plays a lot / The boys play a lot; The boy runs a lot / The boys run a lot;
2	O Manuel leva a bola / O Manuel levou a bola; O Manuel atira a bola / O Manuel atirou a bola;	Present to past	Manuel takes the ball / Manuel took the ball; Manuel throws the ball / Manuel threw the ball;
3	Eles vêem uma estrela / Eles viram uma estrela; Eles passeiam no jardim / Eles parrearam no jardim;	Present to past + Irregular to regular verbs	They see a star / They saw a star; They walk in the garden / They walked in the garden;
4	A Ana comprou a boneca / A Ana compra a boneca; A Ana vestiu a boneca / A Ana veste a boneca;	Past to present + different verb thematic vowels: comprar - vestir	Anna bought a doll / Anna buys a doll; Anna dressed the doll / Anna dresses the doll;
5	Eu comi o almoço / Eu comerei o almoço; Eu brinquei de manhã / Eu bricarei de manhã;	Past to future + different verb thematic vowels: comer – brincar	I had my lunch / I will have my lunch; I played in the morning / I will play in the morning;
6	Eu gosto de correr / Eu gostaria de correr; Eu desço do escorrega / Eu desceria do escorrega;	Present to conditional	I enjoy to run / I would enjoy to run; I slide down / I would slide down ;
7	O pai compra o pão / O pai vai comprar o pão; O Pai faz o jantar / O pai vai fazer o jantar;	Present to present continuous	My father buys bread / My father is going to buy bread; My father cooks dinner / My father is going to cook dinner;
8	Se eu comesse um rebuçado / Se eu comer um rebuçado; Se eu fosse ao cinema / Se eu for ao cinema;	Subjunctive present to subjunctive future	If I had eaten a candy / If I will eat a candy; If I had gone to the cinema / If I will go to the cinema;
9	Eu comi um bolo / Se eu comesse um bolo; Eu fugi para o jardim / Se eu fugisse para o jardim;	Past to subjunctive + different verb thematic vowels: comer – fugir	I ate a cake / If I had eaten a cake; I ran away to the garden / If I had ran away to the garden;
10	Eu fiz um desenho / Se eu fizesse um desenho; Eu aplaudi o cantor / Se eu aplaudisse o cantor;	Past to subjunctive + different verb thematic vowels: fazer – aplaudir	I did a drawing / If I had done a drawing; I applauded the singer / If I had applauded the singer;

Notes: The text in bold represents the expected answers by the child. Transformations in verbs with different thematic vowels occur in verbs belonging to different conjugations.

According to the instructions in Nunes et al., (1997, a), the experimenter used two finger puppets to present the tasks. In the Word Analogy task, the first puppet 'said' a word (e.g. 'andar', to walk) and the second 'repeated' the word with a change in its derivational or inflectional components (e.g. 'andou', he walked). Then the first puppet 'said' a third word (e.g. 'tremar', to shake) and the child was required to take the place of the second puppet and produce the fourth word ('tremeu', he shook). The procedure was the same with the Sentence Analogy task, where the puppets 'said' sentences instead of single words.

One practice trial (PT) with feedback was provided before the experimental trials. No feedback was given thereafter. Children were instructed to ask for a repetition, if they needed to, in order to assure that wrong answers were not just caused by the difficulty to keep in memory the first three items in each trial. The experimenter also repeated the items if the child did not provide any answer.

Children performed the analogy tasks orally and the experimenter wrote down their answers.

Each item was scored as correct (1) when the child made the correct morphological transformation by analogy (indicated in bold in the tables 4.2 for Word Analogy and 4.3 for Sentence Analogy). A score of (0) was given otherwise.

4.4.2 - The spelling task

Children were asked to spell words and pseudo-words presented orally in the context of sentences.

The spelling task contained 96 stimuli (Appendix 4.1). These were divided in two lists of 48 stimuli. The first list was spelled on one day and the second on the consecutive school day. Each list was presented in the same order to all children. Words and pseudo-words were mixed in the two lists.

The stimuli were of three sorts. There were 32 stimuli assessing consistency in the spelling of stems, 32 stimuli assessing the spelling of words and pseudo-words ending in the homophone suffixes ‘-esa’ and ‘-eza’ and 32 other stimuli assessing the spelling of words and pseudo-words ending in the homophone suffixes ‘-ice’ and ‘-isse’.

4.4.2.1. – Consistency in the spelling of stems

In order to assess children’s consistency in the spelling of stems they were asked to spell 16 derived words on one day and 16 base words on a consecutive day. On the first day, they spelled 8 derived words formed by a real stem plus a real suffix in a legal combination (e.g., ‘fornada’, a full oven), and 8 pseudo-words formed by a real stem plus a real suffix in a non-existing combination (e.g., ‘tamboreiro’). In this pseudo-word the stem ‘tambor’ is equal to the stem in the base form, meaning ‘the drum’, and the suffix ‘-eiro’ is an agentive suffix meaning ‘someone who does something’, such as the suffix ‘-er’ in English. Thus, if ‘tamboreiro’ were to exist it would mean ‘someone who plays the drum, or a drummer’. Similarly to the English suffix ‘-er’, ‘-eiro’ is a derivational suffix that forms nouns related to an activity or a profession, such as ‘padeiro’(baker) or ‘carpinteiro’(carpenter).

On the second day, 16 base words, whose stems corresponded to the derived ones (e.g., ‘forno’, the oven and ‘tambor’, the drum) were spelled (Sub-total = 32 stimuli).

The base words have stems with clearly articulated vowels and a transparent spelling. The derived words and pseudo-words have stems with vowels that are changed in the pronunciation. For example, in ‘tambor’, the underlined vowel is clearly pronounced as /o/ and is stressed and in the pseudo-derived form ‘tamboreiro’ the same vowel is pronounced as a schwa /w/ and is unstressed.

All words and pseudo-words appeared in a sentence context.

Table 4.4 presents some examples of the stimuli that were used to assess consistency in the spelling of stems.

Table 4. 4: Examples of the stimuli that were used to assess consistency in the spelling of stems.

Stems in Derived forms		
	Words	Pseudo-words
Stems in Base forms:		
Tambor (drum)		Tamboreiro
Aroma (scent)		Aromista
Forno (oven)	Fornada (a full oven)	
Calor (heat)	Calorento (feeling hot)	
Passeio (walk)		Passeagem
Recreio (playground)		Recreal
Aldeia (village)	Aldeamento (group of houses)	
Areia (sand)	Areal (sand shore)	

4.4.2.2. – Discrimination in the spelling of homophone suffixes

To assess children’s discrimination in the spelling of stimuli with homophone suffixes there were 8 words with each of the four suffixes and the same number of pseudo-words. For example, the suffix ‘-eza’ was assessed with 8 abstract nouns such as ‘beleza’ (beauty) and with the same number of pseudo-words. The same was true of its homophone ‘-esa’ as well as ‘-ice’ and ‘-isse’.

The sentences were constructed so that the morphological status of the stimulus with the suffix was unambiguous. For example, in the sentence ‘Ninguém deve viver na pobreza’ (Nobody should live in poverty), ‘pobreza’ is an abstract noun, therefore written with ‘-eza’. This was especially important in sentences using pseudo-words. For example, in the sentence ‘A minha avó nasceu em Alique; é Aliquesa’ (My grand-mother was born in Alique; she is

Aliquesa), the name of a place of birth (a pseudo-word) was provided to make sure that Aliquesa was a (pseudo) noun related to provenance, therefore spelled with ‘-esa’.

Table 4.5 displays some examples of sentences used with each suffix and with Words (W) and Pseudo-words (PW).

Table 4.5: Examples of the spelling task for the spelling of homophone suffixes

Suffixes	Word Type	Sentences
‘- esa’	W	Japonesa. Esta boneca é Japonesa. Japonesa (Japanese. This doll is Japanese. Japanese)
	PW	Arlinesa. Se ela vive em Arlina é Arlinesa. Arlinesa. (Arlinesa. If she lives in Arlina she is Arlinesa. Arlinesa)
‘-eza’	W	Pobreza. Ninguém deve viver na pobreza. Pobreza. (Poverty. Nobody should live in poverty. Poverty)
	PW	Malideza. Este senhor age com malideza. Malideza (Malideza. This gentleman acts with malideza. Malideza)
‘- ice’	W	Parvoíce. Tu disseste uma grande parvoíce. Parvoíce (Foolish. What you just said is foolish. Foolish)
	PW	Bafarice. Ele só quer é fazer bafarice. Bafarice (Bafarice. The only thing he wants to do is bafarice. Bafarice)
‘-isse’	W	Rugisse. Eu fugia se o leão rugisse. Rugisse (Roared. I would run away if the lion had roared. Roared)
	PW	Atrabisse. Era bom se ele atrabisse. Atrabisse (Atrabisse. It was nice if he had atrabisse. Atrabisse)

The whole spelling task took place in a different room and in small groups of 6 to 10 children.

The experimenter, a native Portuguese (European Variant) speaker, presented each sentence orally.

On the first day in which children did the spelling task, they were given the following instruction, orally:

“You are helping me to understand how children learn how to spell words. To do that, you are going to write down some words on the paper that I have given to you. Be aware that some of the words do not exist. I invented them. Other words are real ones.

It is possible that you will have doubts about how to spell some words. Do not ask for clues to the spelling because I will not be able to answer you. Please, do not make comments aloud because you can influence your colleagues. Write down all the real and invented words the way you think is the best.

Now! Let us start!

I will read a word first, then I am going to read a sentence and finally the same word that I read first. The word that I repeat is the one that you are going to write down on your paper.

Let us do the first one. ‘Japonesa. Esta boneca é Japonesa. Japonesa’ (Japanese. This doll is Japanese. Japanese)”.

No feedback was given throughout the task. When the task was over children were thanked for their participation and told that we would meet the following day to spell some more real and invented words.

On the second day a shortened version of the instruction was given just to remind the children how the task was performed. Children were told: *“Yesterday you wrote some words and you did it very well. Today you are going to do the same. Do not forget that some of the words are real and others are invented.*

Let us start! Write down the word that I repeat. 'Bigode. Aquele homem tem um grande bigode. Bigode' (Moustache. This man has a big moustache. Moustache)''.

4.4.2.3 – The scoring of the spelling tests

4.4.2.3.1 – Consistency in the spelling of stems

Children's spelling of stems was scored as consistent (1) if they were spelled the same way in the base and derived forms, or as inconsistent (0) if not.

Examples: (1) "tambor – tamboreiro". (0) "tambor – tambureiro".

Two outcome variables were computed. The first, Consistency in the Spelling of Stems in Base – Derived words. The second was Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli. The maximum possible score was 8 in each of the variables.

4.4.2.3.2 - Discrimination of homophone suffixes

The spelling of each of the homophone suffixes was scored as morphologically correct (1) when the only one accurate spelling was given, and as incorrect (0) in any other cases.

Correct scores were those in which the only one acceptable morphological spelling for each morpheme, '-esa', '-eza', '-ice' and '-isse', was fully respected. All other representations, even if phonologically acceptable were scored as incorrect.

After calculating the amount correct and incorrect each child's score was transformed into a discrimination score corrected for chance.

The discrimination score weighs the number of correct responses by the number of incorrect ones.

Two methods were attempted. The first is proposed by Guilford (1954) in which the number of incorrect answers divided by the number of spelling possibilities minus one is subtracted

from the number of correct answers. The second is proposed by Snodgrass & Corwin (1988), in which the proportion of wrong answers is subtracted from the proportion of right answers.

Guilford's formula appears more sensitive for differences in the number of spelling possibilities in each pair of homophone suffixes that are 'sensible'. 'Sensible' means spellings for which the child used correct plus phonologically acceptable representations for the sounds in each suffix. For example the middle sound /z/ in '-esa' and '-eza' appears in the language represented by 'z', 's' and 'x', although the latter is less frequent. As for the suffixes '-ice' and '-isse', the middle sound /s/ can be represented in the language by 'c', 'ss', 'ç' and 's'. The Guilford's formula takes this into consideration because the number of wrong answers is divided by the *number of spelling possibilities* (and not number of items, as in Snodgrass) before being subtracted from the number of correct answers.

In '-esa / eza', children used two 'sensible' spelling possibilities [-esa; -eza] most of the time, but in '-ice' / '-isse' they have used five [-ice; -isse; -ise; -içe; i-se]. Thus, in '-esa' / '-eza' wrong scores are divided by 1 (2 spelling possibilities -1) and in '-ice' / '-isse', by 4 (5 spelling possibilities -1). This allows for a better balance of discrimination as a function of the number of alternative 'sensible' spellings that children have to learn, and not just number of items. A second feature in favour of Guilford's formula was that, contrary to Snodgrass & Corwin, Guilford does not correct fully discriminated scores. For example, a child that has 16 out of 16 correct, will keep that score intact in Guilford and have it slightly reduced when Snodgrass & Corwin's correction is computed. Guilford's formula appears to assume that fully consistent correct scores are determined by consistency of knowledge, not chance. Snodgrass & Corwin's formula appears to suggest that some chance is still possible when a child systematically discriminates the spelling of suffixes. Guilford's approach appears to be more accurate in this matter.

For the above reasons Guilford's discrimination formula is used in the following analyses. It is pointed out though, that a correlation of 1.00 is found between the scores transformed by both methods.

The discrimination score (Guilford, 1954) has a distribution with a middle value of 0, meaning that the number correct equals the number incorrect. The maximum possible score is 16 when the child spelled the 8 items in the first suffix and the 8 items in its homophone, correctly. The minimum possible score is -16, indicating that the child could not spell any of the 8 items in each suffix, accurately. Thus, negative scores mean that the spelling tends to be systematically wrong and positive scores indicate a positive shift towards a more accurate discrimination.

4.4.3 - Standardised measure

Each child was seen individually in a quiet room and presented with a shortened version of WISC, standardised for the Portuguese population by Marques (1970). This measure provides control for a more general factor, intelligence (IQ).

Children were tested on 4 sub-tests of each Verbal (Vocabulary, Digit Span, Similarities and Arithmetic), and Performance (Picture Completion, Picture Arrangement, Block Design and Object Assembly) IQ sub-scales. Standardised scores for Verbal IQ, Performance IQ and Full-scale IQ were computed. The last score was used in all subsequent analyses. The procedure and scoring was as detailed in the WISC Manual (Marques, 1970).

4.5 – RESULTS

4.5.1 – Analyses of reliability and skewness

Because the measures used in this study had been created or adapted from studies in English, the scores in the morphological awareness and outcome measures were examined for reliability and normality of distributions.

Reliability analysis of the items of a scale refers to whether the answers in each of the items are internally consistent. High internal consistency is an indication that the scale is measuring the same variable (Kline, 1993). According to Kline (1993) reliability analysis should be performed on a sample *‘of sufficient size to minimise statistical error. A minimum size sample would be 100 subjects. (...) reliabilities should ideally be high, around .9, especially for ability tests. Certainly, alphas should never drop below .7’* (pp. 10-11).

The sample size in this study is higher ($N = 184$) than the proposed by Kline (1993). Table 4.6, displays the results for items' reliability.

The table shows that, with the exception of Word Analogy, all measures are highly reliable. Good reliability is an indication that all the items in each measure are closely associated and consistent in how they measure a specific ability. Reliability for Word Analogy is still acceptable as it is within the limit of .7 proposed by Kline (1993).

Skewness analysis tests the null hypothesis that the sample comes from a symmetrical population and (z) is obtained by dividing the skewness by the standard error of the skewness. According to Howitt & Cramer (1997) *‘if the resulting value equals or exceeds 1.96 then your skewness is significant at the 5% level (two-tailed test) and the null hypothesis that your sample comes from a symmetrical population should be rejected’* (p. 340). However, (z) values equal or lower than 2 are usually accepted as non-significantly skewed.

Table 4.6 displays the results that were found.

Table 4.6: Reliability (Alpha, $p < .05$) and Skewness ($p < .05$) for Word Analogy, Sentence Analogy, Consistency in the Spelling of Stems and Spelling of Homophone Suffixes

	Number of items	Items' Reliability	Skewness (z)
Predictors:			
Word Analogy	10	.71	1.99
Sentence Analogy	10	.86	3.97 (a)
Outcome variables:			
Consistency in the spelling of stems:			
- Base – Derived Words	16	.84	1.69
- Base – Pseudo-derived stimuli	16	.83	1.55
Discrimination of homophone suffixes:			
- ‘-esa’/ ‘-eza’ Words	16	.80	-2.59 (b)
- ‘-esa’/ ‘-eza’ Pseudo-words	16	.83	-7.16 (c)
- ‘-ice’ / ‘-isse’ Words	16	.92	3.26 (d)
- ‘-ice’ / ‘-isse’ Pseudo-words	16	.85	0.42
[Whole spelling task]	[96]	[.93]	[-1.35]

Notes: (a) $z = -.062$, after normalisation by Square Root; (b) $z = 0.05$, after normalisation by Rank Normal Blom method ; (c) $z = 0.08$, after normalisation by Rank Normal Blom method; (d) $z = 2.22$, approaches normalisation by Rank Normal Blom method.

The results for skewness (z) show that the scores in many of the measures are normally distributed. It was possible to normalise the scores of Sentence Analogy by square rooting the individual scores. In the case of discrimination of homophone suffixes, normalisation in the skewed variables was achieved by using a Rank Normal - Blom test (Blom, 1958). The ‘z’ of

the normalised variables is reported as a note, below Table 4.6. Different methods of normalisation were attempted, unsuccessfully, with Discrimination of '-ice'/'-isse Words. The Blom method provided the best possible approach to a non-skewed distribution.

Although it is generally accepted that good reliability of measures is indispensable, there is much debate as to whether skewness is as important. Howell (1997) states that *'there are statistical measures of the degree of asymmetry, or skewness, but they are not commonly used in the social sciences. (...) As an educated person, you should know what a positively skewed distribution is, even though it is unlikely that you will ever want to compute a numerical index of skewness. You should be aware, however, that these measures are important to statisticians, who might rightly be annoyed by the cavalier way I seem to be dismissing them. I downplay these measures because they are less useful to a user of statistics than to the professional'* (pp. 28, 29).

Other authors such as Coakes & Steed (1999) clearly state the need for normality assumption in analyses of covariance and regression, to name just those that are reported next. Coakes & Steed (1999) state that in the analysis of covariance *'the dependent variable should have a normal distribution'* (...) but *'if the scores for the covariate alone are normally distributed, then ANCOVA is robust to this assumption'* of normality. In this study, IQ, which is a normally distributed variable, will be used as a covariate.

As for multiple regression analysis, Coakes & Steed (1999) defend that one of the assumptions is that *'the differences between the obtained and predicted dependent variable scores are normally distributed'*. However, they add that *'mild deviations from linearity are not serious. Moderate or extreme deviations may lead to a serious underestimation of a relationship'* (p. 168).

In multiple regression analysis, the outcome variables need to be normally distributed but the predictors need not. As stated by Guilford & Fruchter (1973) one can predict *'measurements from attributes, as when we predict probable test scores from sex, socio-economic status, or marital status'* (p.327). Attributes, by definition, are measured as categories or nominal data that cannot be understood as normally distributed.

4.5.2 – Analysis by Normal Probability Plots

Despite the fact that one does not need to have normally distributed predictors, Normal Probability Plots examined whether the observed scores of Word Analogy and Sentence Analogy deviated sharply from normality. These compare the observed scores with those that would be obtained in a normal distribution. A normal distribution of the observed scores may be assumed if they do not deviate sharply from a straight line. Figure 4.1 displays those plots.

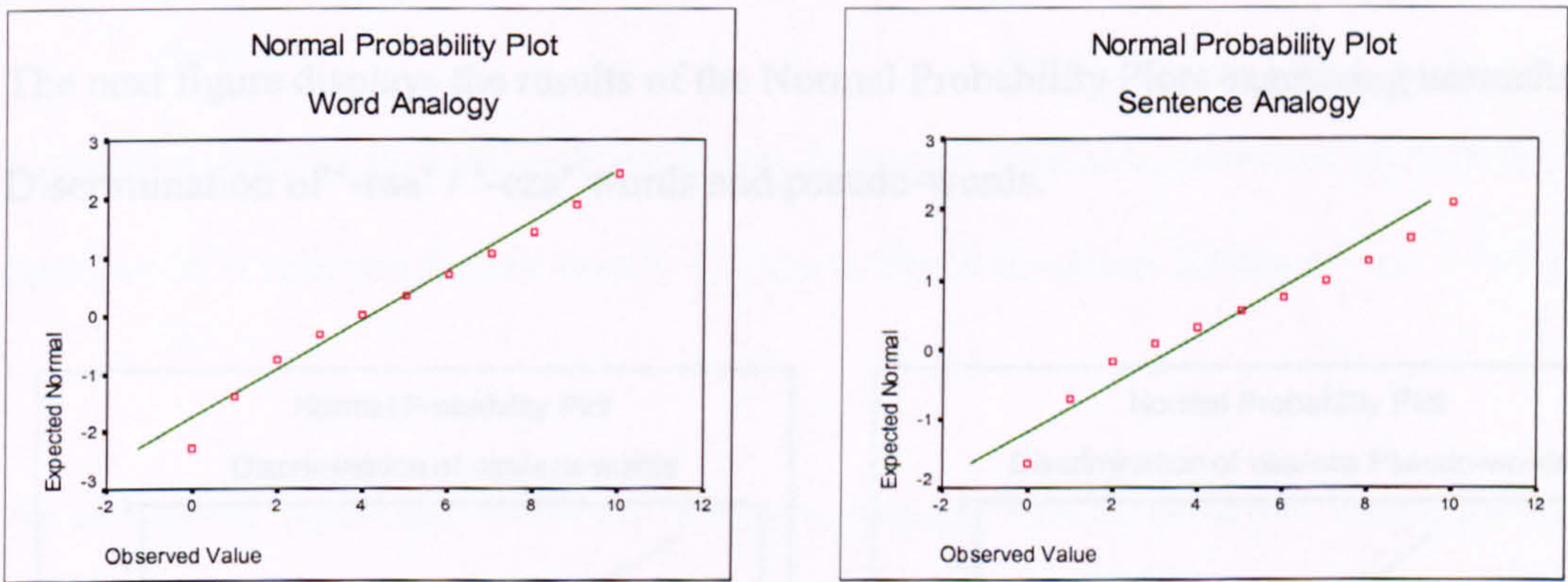


Figure 4.1: Normal Probability Plots for the predictors, Word Analogy and Sentence Analogy in Session A.

The results clearly indicate that the expected and observed values do not deviate sharply from a straight line and thus normality of distribution can be assumed.

Normal probability plots were also conducted on all outcome variables. Figure 4.2 displays what was found for Consistency in the Spelling of Stems.

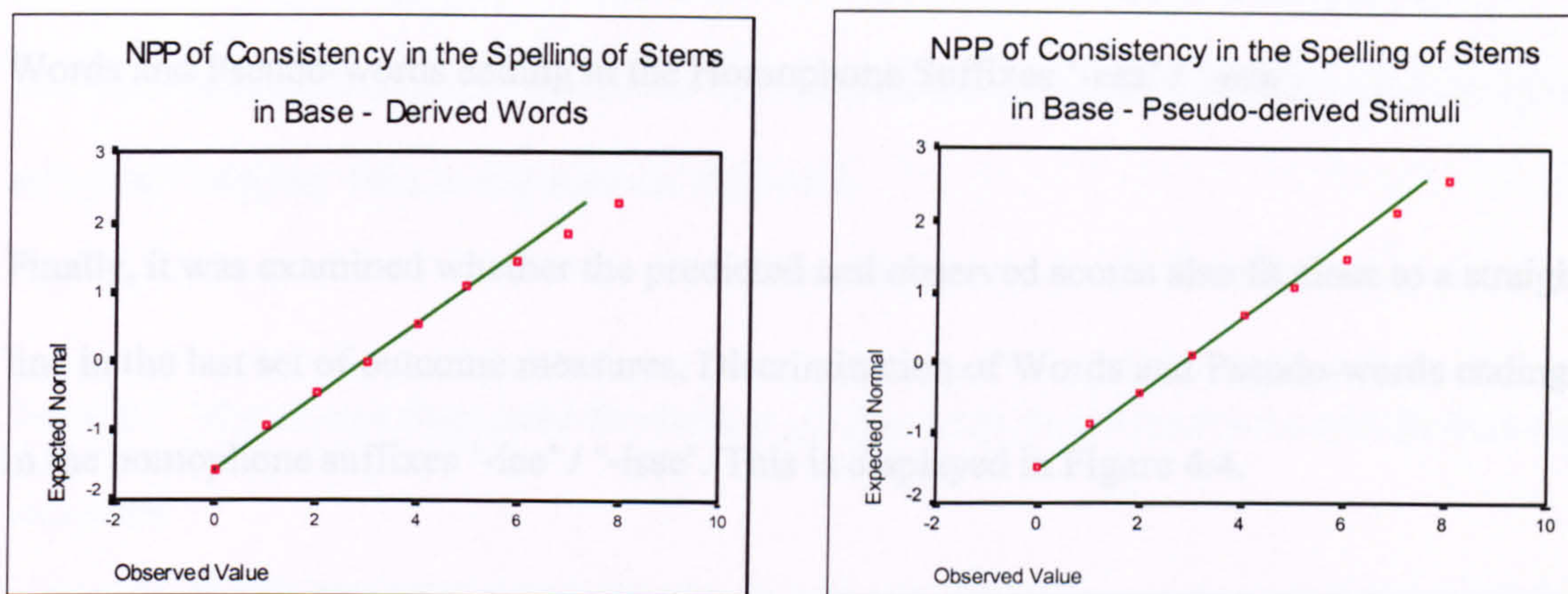


Figure 4.2: Normal Probability Plot for the Outcome Variables, Consistency in the Spelling of Stems in Base – Derived Words and in Base – Pseudo-derived stimuli.

It can be concluded that the expected and the observed scores in the first two outcome measures do not deviate from what should be expected in a normal distribution, and therefore normality can be assumed.

The next figure displays the results of the Normal Probability Plots examining normality for Discrimination of ‘-esa’ / ‘-eza’ words and pseudo-words.

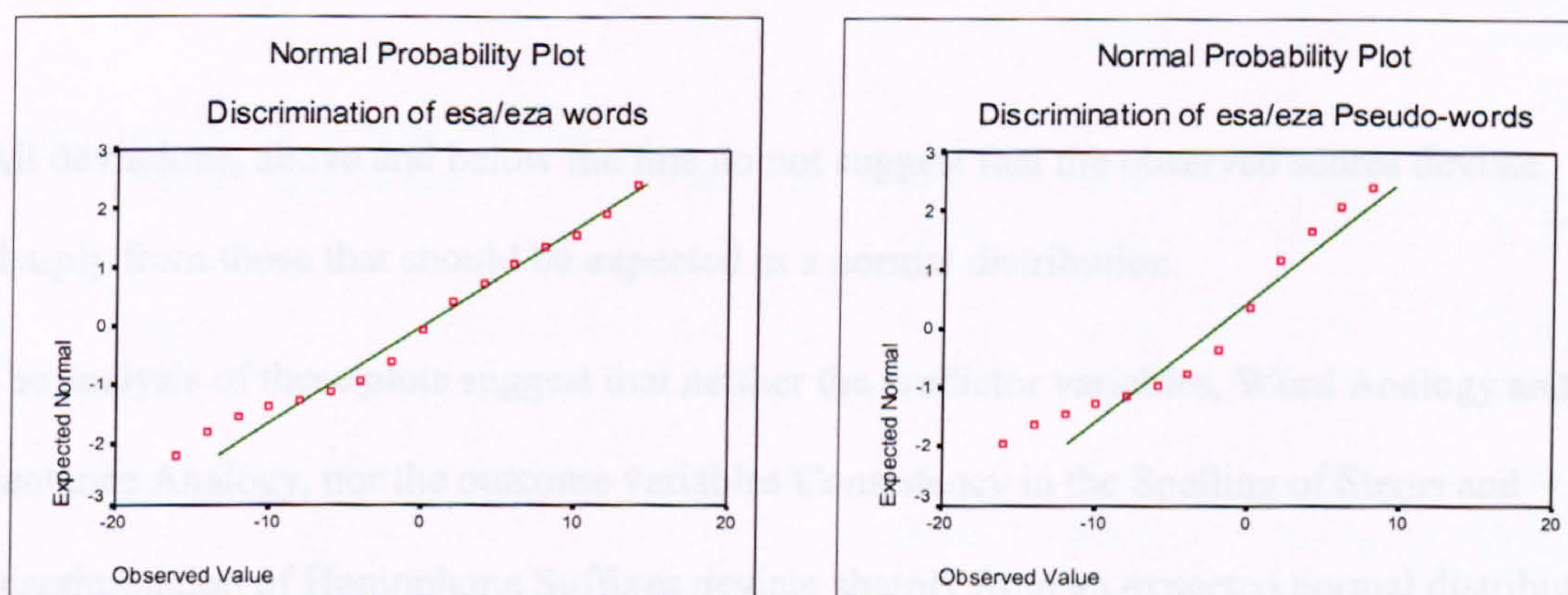


Figure 4.3: Normal Probability Plots for the Outcome Variables, Discrimination in the Spelling of Words and Pseudo-words Ending in the Homophone Suffixes ‘-esa’ / ‘-eza’.

There are only mild deviations and thus, one can assume normality for Discrimination of Words and Pseudo-words ending in the Homophone Suffixes ‘-esa’ / ‘-eza’.

Finally, it was examined whether the predicted and observed scores also fit close to a straight line in the last set of outcome measures, Discrimination of Words and Pseudo-words ending in the homophone suffixes ‘-ice’ / ‘-isse’. This is displayed in Figure 4.4.

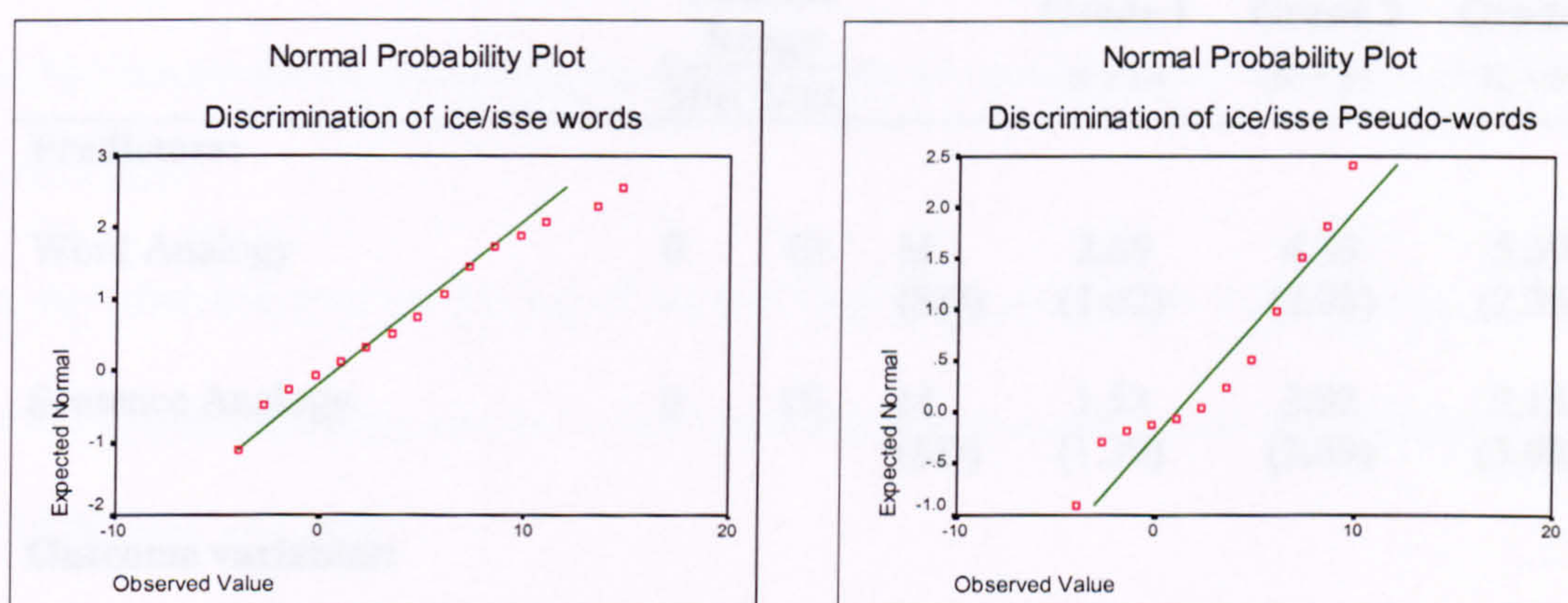


Figure 4.4: Normal Probability Plots for the Outcome Variables, Discrimination in the Spelling of Words and Pseudo-words Ending in the Homophone Suffixes ‘-ice’ / ‘-isse’.

All deviations, above and below the line do not suggest that the observed scores deviate sharply from those that should be expected in a normal distribution.

The analysis of these plots suggest that neither the predictor variables, Word Analogy and Sentence Analogy, nor the outcome variables Consistency in the Spelling of Stems and Discrimination of Homophone Suffixes deviate sharply from an expected normal distribution. Because of that, the original variables will be used in the subsequent analyses.

4.5.3 – Analysis of Means and Standard Deviations

The next analysis looked into the means and standard deviations of both the predictors and the outcome variables. This is displayed in Table 4.7.

Table 4.7: Means and Standard Deviations (in brackets) for the predictors and the outcome measures

	Possible Range			Grade 1	Grade 2	Grade 3
	Min	Max		N = 64	N = 61	N = 59
Predictors:						
Word Analogy	0	10	M (SD)	2.69 (1.62)	4.33 (2.08)	5.59 (2.36)
Sentence Analogy	0	10	M (SD)	1.53 (1.39)	3.92 (2.69)	5.15 (3.08)
Outcome variables:						
Consistency in spelling stems:						
- Base – Derived Words	0	8	M (SD)	1.55 (1.33)	3.11 (1.42)	4.44 (1.64)
- Base – Pseudo-derived	0	8	M (SD)	1.89 (1.45)	2.84 (1.66)	3.88 (1.86)
Discrimination of hom. suffixes:						
- ‘-esa’/ ‘-eza’ Words	-16	16	M (SD)	-3.97 (6.07)	1.02 (4.97)	3.56 (4.17)
- ‘-esa’/ ‘-eza’ Pseudo-words	-16	16	M (SD)	-4.38 (6.14)	-.75 (3.67)	-1.22 (3.34)
- ‘-ice’ / ‘-isse’ Words	-16	16	M (SD)	-1.05 (3.87)	1.25 (4.44)	2.36 (4.20)
- ‘-ice’ / ‘-isse’ Pseudo-words	-16	16	M (SD)	-1.09 (4.16)	1.90 (4.64)	2.57 (3.99)

Note: Discrimination scores (Guilford, 1954) are displayed for the spelling of suffixes.

The table shows that there is an increase with Grade in all the predictor and outcome measures. Children's abilities to use awareness of morphology as well as the ability to use consistency in the spelling of morphologically related stems develop as schooling progresses. As to the ability to accurately discriminate the spelling of homophone suffixes the same pattern applies except for the fact that in the spelling of '-esa' / '-eza' Pseudo-words second and third graders make no apparent progress.

This pattern indicates that what children know about morphological relations between words and sentences and the knowledge that they bring to the spelling follow similar improvements with Grade.

In the following analyses, the significance of these mean differences will be tested.

It was hypothesised (hypothesis 1) that *morphological awareness is an ability that improves significantly with grade.*

It was examined first whether the two morphological awareness measures were significantly correlated in order to make sure that both were assessing the same kind of process. A highly significant correlation was found ($r = .69, p < .001$) between Word Analogy and Sentence Analogy. This correlation could reflect internal variance cumulatively explained by Grade and IQ. In order to control for this, a partial correlation controlling simultaneously for the effects of Grade and IQ was obtained. Word Analogy and Sentence Analogy remained significantly correlated ($r = .45, p < .001$) after this stringent control.

These findings suggest that Word Analogy and Sentence Analogy measure the same ability, i.e., an increase or decrease in one measure is accompanied with a similar move in the other. Moreover, the results also suggest that it is highly possible that both measures assess equivalent processes. These processes are likely to be specific because of its independence from more general factors such as Grade and IQ.

In order to examine whether the mean differences in the morphological awareness measures were significant a multivariate analysis of covariance (ANCOVA) was conducted with Word Analogy and Sentence Analogy as the dependent variables and Grade (3: 1, 2, 3) as the main between-subjects factor. IQ was entered as a covariate, to make sure that any effects of Grade on the morphological awareness measures could not be explained by a third factor.

This analysis revealed a significant Grade effect in both Word Analogy ($F(2, 180) = 55.20, p < .001$) and in Sentence Analogy ($F(2, 180) = 50.13, p < .001$). The same results were obtained with Sentence Analogy normalised by square root ($F(2, 180) = 47.83, p < .001$).

Post-hoc Student-Newman-Keuls (SNK) tests ($p < .05$) revealed that significant differences were found between all Grade comparisons. The mean scores in Word Analogy and in Sentence Analogy were significantly higher in Grade 3 than in Grade 2, and in turn, than in Grade 1.

These results support the hypothesis that morphological awareness is an ability that improves significantly as children develop, after controlling for differences explained by IQ.

4.5.4 – Analyses of significance of mean differences

It was also hypothesised (hypothesis 2) that *consistency in the spelling of stems and discrimination of homophone suffixes improve significantly with grade.*

A multivariate analysis of covariance (ANCOVA) was conducted in order to examine whether the mean differences in consistency in the spelling of stems and discrimination of homophone suffixes were significant. All spelling measures were entered as dependent variables and Grade (3: 1, 2, 3) was a between-subjects factor. In order to exclude that any effects of Grade on the dependent variables were not biased by extraneous effects of IQ, the

latter was entered as a covariate. Table 4.8 summarises the results that were found for all the spelling tasks.

Table 4.8: Summary of results for **analyses of covariance (ANCOVA)**, controlling for IQ, between the dependent variables (consistency in the spelling of stems and discrimination in the spelling of words and pseudo-words ending in homophone suffixes) with Grade as the main factor.

Dependent Variables	F df = (2, 180)	Sig.	Post-hoc SNK tests
Consistency in spelling stems:			
- Base – Derived Words	66.26	p < .001	Grade 1 < 2 < 3
- Base – Pseudo-derived	27.28	p < .001	Grade 1 < 2 < 3
Discrimination of homophone suffixes:			
- ‘-esa’/ ‘-eza’ Words	39.11	p < .001	Grade 1 < 2 < 3
- ‘-esa’/ ‘-eza’ Pseudo-words	13.81	p < .001	Grade 1 < 2 = 3
- ‘-ice’ / ‘-isse’ Words	13.25	p < .001	Grade 1 < 2 = 3
- ‘-ice’ / ‘-isse’ Pseudo-words	16.12	p < .001	Grade 1 < 2 = 3

After controlling for differences explained by IQ a significant effect of Grade was found in all dependent variables. Post-hoc SNK tests showed that there was a significant improvement in all Grades in Consistency in the Spelling of Stems (Base – Derived and Base – Pseudo-derived) and in Discrimination of Words with the Homophone Suffixes ‘-esa’/ ‘-eza’. In these variables, children in Grade 1 were significantly less accurate than those in Grade 2 which, in turn, were less accurate than those in Grade 3. In the remaining measures children in Grade 1

were significantly less accurate than children in Grades 2 and 3. The latter two Grades did not differ. The same pattern of significant results was found in all variables, previously reported as significantly skewed, when the normalised scores were analysed for Grade differences, controlling for IQ. The results of the ANCOVA analyses revealed that Discrimination of ‘-esa’ / ‘-eza’ Words ($F(2, 180) = 39.96, p < .001$), Discrimination of ‘-esa’ / ‘-eza’ Pseudo-words ($F(2, 180) = 10.82, p < .001$), and Discrimination of ‘-ice’ / ‘-isse’ Words ($F(2, 180) = 15.85, p < .001$) were significantly dependent on Grade, after controlling for IQ differences. The same inter-group comparisons were also found.

This pattern of results supports the hypothesis that consistency in the spelling of stems and discrimination of homophone suffixes improves significantly as children develop. The pattern of development differs with the nature of the spelling issues involved. For some, improvement is observed across all grades. In others, the major improvement appears after the first grade but performance stabilises in grades 2 and 3.

4.5.5 – Analyses of the relation between morphological awareness and morphologically based spellings

The third hypothesis was that *there is a predictive relation between morphological awareness and consistency in the spelling of stems, and between morphological awareness and discrimination in the spelling of words and pseudo-words ending in homophone suffixes, which cannot be explained by the fact that the two relate to a third factor.*

Fixed order hierarchical multiple regressions were performed in order to examine whether there is a predictive relation between morphological awareness and each of the spelling measures. In each regression one of the spelling measures was entered as the outcome measure. In all regressions Grade was entered as the first step, and IQ as the second step.

Grade and IQ are control factors. The third step was one of the predictors, either Word Analogy or Sentence Analogy.

Entering Grade and IQ in the first two steps examines whether the predictors account for unique variance above and beyond variance explained by those more general factors.

Table 4.9 displays the results for two fixed order hierarchical multiple regressions with Word Analogy and Sentence Analogy as the last third step predicting Consistency in the Spelling of Stems in Base – Derived Words.

Table 4.9: Summary of Two Fixed Order Hierarchical Multiple Regressions Analyses for Word Analogy and Sentence Analogy in Session A, Predicting Consistency in the Spelling of Stems in Base – Derived Words, in Session A

Outcome measure: Consistency in the Spelling of Stems in Base – Derived Words, in Session A					
Order entered in Session A	r ² change	B	SE B	β	Sig. F change
1 – Grade	.392	1.45	.132	.631	.001***
2 – IQ	.032	.039	.012	.180	.002**
3.1 – WA	.000	.022	.063	.028	.728
3.2 - SA	.008	.079	.048	.121	.104

* p<.05; ** p<.01; *** p<.001

This table shows that Grade and IQ are the only significant contributors with unique variance to the regression equation. Neither Word Analogy nor Sentence Analogy provides added significant variance. This suggests that Consistency in the Spelling of Stems in Base –

Derived Words is not significantly explained by morphological awareness as measured by the two tasks.

Table 4.10 displays the results for two fixed order hierarchical multiple regressions with Word Analogy and Sentence Analogy entered as the last third step predicting Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli.

Table 4.10: Summary of Two Fixed Order Hierarchical Multiple Regressions Analyses for Word Analogy and Sentence Analogy in Session A, Predicting Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli, in Session A

Outcome measure: Consistency in the spelling of stems in Base – Pseudo-derived stimuli, in Session A					
Order entered in Session A	r ² change	B	SE B	β	Sig. F change
1 – Grade	.197	.995	.149	.443	.000***
2 – IQ	.073	.056	.014	.272	.001**
3.1 – WA	.017	.143	.069	.184	.040*
3.2 - SA	.020	.119	.053	.187	.026*

* p<.05; ** p<.01; *** p<.001

This Table shows that the control variables Grade and IQ account for 20 % and 7 %, respectively, of unique variance but each measure of morphological awareness specifically contributed with an added 2 % of significant variance which cannot be explained by Grade and IQ. This suggests that there is a specific link between Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli and morphological awareness.

It is interesting to question why morphological awareness measures predict Consistency in Base – Derived Words and in Base – Pseudo-derived stimuli differently. It is possible that

children rely on word knowledge to spell stems consistently in the first case but need to consider knowledge of morphology in the pseudo-derived stimuli. In the latter stimuli, their morphological structure is more salient because these are formed by a real stem plus a real suffix in a combination that does not exist. Therefore, the morphological structure of the stimulus becomes more apparent because the whole stimulus is not meaningful but their constituent morphemes are.

The next two tables display the analyses of whether the predictors make a significant contribution for the spelling of words (Table 4.11) and Pseudo-words (Table 4.12) ending in the homophone suffixes ‘-esa’ / ‘-eza’.

Table 4.11: Summary of Two Fixed Order Hierarchical Multiple Regressions Analyses for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-esa’ / ‘-eza’ Words, in Session A

Outcome measure: Discrimination of ‘-esa’ / ‘-eza’ Homophone Suffixes (Words), in Session A					
Order entered in Session A	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.263	3.77	.468	.512	.000***
2 – IQ	.055	.165	.043	.237	.000***
3.1 – WA	.005	.258	.220	.102	.243
3.2 - SA	.020	.386	.167	.185	.022*

* p<.05; ** p<.01; *** p<.001

Grade and IQ explain a significant proportion of the variance in spelling words ending in the homophone suffixes ‘-esa’ / ‘-eza’ but Sentence analogy still contributes with unique variance after controlling for those factors. No significant contribution was found for Word Analogy. These regressions suggest that there is a specific and significant contribution of morphological awareness, as measured by Sentence Analogy, when children spell words ending in the homophone suffixes ‘-esa’ / ‘-eza’.

Table 4.12: Summary of Two Fixed Order Hierarchical Multiple Regressions Analyses for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-esa’ / ‘-eza’ Pseudo-words, in Session A

Outcome measure: Discrimination of ‘-esa’ / ‘-eza’ Homophone Suffixes (Pseudo-Words) in Session A					
Order entered in Session A	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.073	1.61	.423	.271	.000***
2 – IQ	.078	.159	.039	.283	.000***
3.1 – WA	.001	.070	.199	.034	.725
3.2 - SA	.003	.122	.152	.073	.424

* p<.05; ** p<.01; *** p<.001

The results of these regressions show that Grade and IQ account for a similar proportion of significant variance (around 7 %) and that none of the morphological awareness measures contributes significantly to the equation. A big proportion of variance is unaccounted for in the regressions. This suggests that discrimination of the homophone suffixes ‘-esa’ / ‘-eza’ in pseudo-words is not linked to knowledge of morphological relations measured by the analogy tasks.

The next two tables show, now, how the predictors contribute to the spelling of words (Table 4.13) and pseudo-words (Table 4.14) ending in the homophone suffixes ‘-ice’/ ‘-isse’.

Table 4.13: Summary of Two Fixed Order Hierarchical Multiple Regressions Analyses for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-ice’/ ‘-isse’ Words, in Session A

Outcome measure: Discrimination of ICE / ISSE Homophone Suffixes (Words) in Session A					
Order entered in Session A	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.101	1.70	.376	.318	.000***
2 – IQ	.071	.135	.034	.276	.000***
3.1 – WA	.001	.089	.177	.048	.616
3.2 - SA	.013	.231	.135	.152	.089

* p<.05; ** p<.01; *** p<.001

The results reveal that there is a marginal contribution of Sentence Analogy and that Word Analogy makes no specific contribution, after controlling for Grade and IQ. Only the two control variables account for significant unique variance.

Table 4.14:Summary of Two Fixed Order Hierarchical Multiple Regressions Analyses for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-ice’/ ‘-isse’ Pseudo-words, in Session A

Outcome measure: Discrimination of ICE / ISSE Homophone Suffixes (Pseudo-words) in Session A					
Order entered in Session A	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.111	1.85	.388	.332	.000***
2 – IQ	.085	.154	.035	.293	.000***
3.1 – WA	.000	.041	.181	.021	.822
3.2 - SA	.005	.141	.139	.090	.310

* p<.05; ** p<.01; *** p<.001

The results show that there is no specific significant contribution from Word Analogy and Sentence Analogy to variance in the outcome variable after controlling for variance explained by Grade and IQ. These two control variables, together, account for approximately 20 % of the significant variance explained.

To summarise, the regression analyses show that:

- there is a significant and predictive relation between morphological awareness (Word Analogy and Sentence Analogy) and Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli. No relation was found when consistency was required in the spelling of stems in Base – Derived Words.

- There is a significant contribution of Sentence Analogy in predicting discrimination in the spelling of ‘-esa’ / ‘-eza’ words but no relation was found in the spelling of pseudo-words.
- There is no clear relation between morphological awareness and discrimination in the spelling of ‘-ice’ / ‘-isse’ suffixes in neither words nor pseudo-words, although Sentence Analogy approached significance in the former case.

This evidence shows that there is a specific and significant contribution of morphological awareness in some of the spelling measures but not in others. This contribution appears to vary as a function of the spelling issues considered and the nature of the stimuli.

4.5.6 – Summary of the results

- 1 - The measures of morphological awareness, Word Analogy and Sentence Analogy, adapted for this study, showed to be reliable (accounting from 50 % to 74 % of true variance) and normally or nearly to normally distributed.
- 2 – Both measures assess the same kind of knowledge and their relation is specific, i.e., cannot be explained by the influence of extraneous factors such as Grade and IQ.
- 3 - The spelling tests were also highly reliable, accounting from 64 % to 84 % of true variance and their distributions were normal or not deviating sharply from what should be expected in a normal distribution.
- 4 - Morphological awareness is an ability that improves significantly with Grade. The effects of Grade are independent from individual differences in general intelligence (IQ).
- 5 - There are significant Grade effects in all the spelling tests, after controlling for variance explained by IQ. The ability to spell stems consistently in Base – Derived Words and in

Base – Pseudo-derived stimuli improves significantly with Grade and a steady progression is found in all grades. The ability to discriminate the spelling of words and pseudo-words ending in homophone suffixes also improves significantly with Grade. In ‘-esa’/’-eza’ words, improvement occurs in all grades. In the remaining variables, improvement is especially marked from the first to the second grade.

- 6 – A specific and unique contribution, that cannot be explained by more general factors, was found between morphological awareness and Consistency in the Spelling of Stems in Base – Pseudo-derived Stimuli, and between morphological awareness and Discrimination of Words ending in the Homophone Suffixes ‘-esa’/ ‘-eza’. In the remaining spelling measures, the contribution of morphological awareness was marginal or non-significant when concurrent relations in Session A of the longitudinal study are analysed.

4.6 –DISCUSSION AND CONCLUSIONS

The lack of research in Portuguese (European Variant) made it necessary to adapt measures to assess morphological awareness, consistency in the spelling of stems and discrimination in the spelling of homophone suffixes. The results provide evidence that the morphological awareness and spelling measures did capture children’s improvement, as these developed. As grade increased, children showed a significant improvement in the ability to become aware of morphological relations and to develop consistency in the spelling of stems and discrimination in the spelling of words and pseudo-words ending in homophone suffixes.

The two measures of morphological awareness were also strongly associated. This association, under the stringent controls for Grade and IQ that were introduced, suggests that the progress that children make in their explicit awareness of morphological relations is a specific ability that although influenced by general factors is not dependent on them.

The results also partially supported the third hypothesis that morphological awareness plays a significant predictive role in the extent to which consistency in the spelling of stems in Base – Pseudo-derived stimuli and discrimination of words ending in the homophone suffixes ‘-esa’ / ‘-eza’ are achieved.

This supports the findings in other languages on the relation between morphological awareness and the development of consistency in the spelling of stems in base and derived forms (Aidinis, 1998; Carlisle, 1988; Nunes, 1998). As for the spelling of words with homophone suffixes, the results are mixed. On the one hand, significant relations were found between Sentence Analogy and discrimination of ‘-esa’ / ‘-eza’ words (and ‘-ice’ / ‘-isse’ words approached significance) but no significant relations were found in the discrimination of pseudo-words.

The results extend those found in the Brazilian Variant of Portuguese by Da Mota (1995). This researcher examined whether grammatical awareness was specifically related to the spelling of two pairs of homophone suffixes, ‘-am’ / ‘-ão’ and ‘-esa’ / ‘-eza’. As for the first pair, it is unclear whether a specific relation with morphological awareness is necessary, because a phonological strategy based on whether the ending suffixes are stressed or not, is sufficient. As for the second pair, ‘-esa’ / ‘-eza’ the conclusions are drawn over a spelling task with only three words ending in each suffix, which is insufficient to interpret the correlations or logistic regressions that are reported. She found a significant positive correlation of .21 between the Analogy Task and the correct spelling of ‘-eza’ with abstract nouns, but did not control for any extraneous variables in this analysis. Later she reports a logistic regression with the correct spelling of ‘-eza’ as the dependent variable, controlling first for age, grade and social class, followed by one of the morphological awareness measures in the last step. The only significant contribution was Grade with no effect found from age or social class and no prediction from morphological awareness. No regression analysis is reported for the suffix

‘-esa’. However, the main problem was that she analysed the relation between morphological awareness and the spelling of each of the suffixes without using a discrimination score. The fact that one suffix is systematically correct does not hold if the spelling of the homophone suffix follows the same spelling pattern. What this indicates is that the child uses one form of spelling for the two suffixes and therefore it is impossible to conclude that any differentiation exists. Analyses based on each suffix and forgetting which spelling options are used in the pair are difficult to interpret.

The present study extends Da Mota’s findings in that a specific relation from morphological awareness to the spelling of ‘-esa’/ ‘-eza’ words was found, taking into consideration the number of spellings that were accurately **discriminated in the pair of suffixes**, after stringent controls for Grade and IQ.

To conclude, morphological awareness (as measured by the Word Analogy and the Sentence Analogy Tasks) plays a specific and significant role in predicting consistency in the spelling of stems in base – pseudo-derived stimuli. Morphological awareness (as measured by the Sentence Analogy Task) plays an equivalent role in predicting discrimination of ‘-esa’ / ‘-eza’ words. These predictions cannot be explained by third factors such as Grade and IQ.

Because only the concurrent relations in Session A were analysed, it is possible that the pattern of predictions is different and more consistent if examined longitudinally. This will be the object of the next three chapters. Longitudinal predictions for Consistency in the Spelling of Stems, Discrimination of ‘-esa’/ ‘-eza’ Words and Pseudo-words, and Discrimination of ‘-ice’/ ‘-isse’ Words and Pseudo-words will be examined in chapters 5, 6 and 7, respectively.

Chapter 5

Study 3 - Morphological Awareness and

Consistency in the Spelling of Stems: Longitudinal study

5.1 - RATIONALE

The aim of this study is to examine the hypothesis that there is a predictive relation between morphological awareness and the development of consistency in the spelling of stems.

Evidence was found in the previous chapter, that morphological awareness is specifically related to consistency in the spelling of stems, when these abilities were assessed concurrently, in Session A. Specific and significant predictions were found from Word Analogy and Sentence Analogy to Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli, after controlling for shared variance with Grade and IQ.

This chapter examines the same hypothesis longitudinally.

Performing both concurrent and longitudinal analyses provides a stronger test of whether there is a strong and specific relation between morphological awareness and consistency in spelling stems.

It is expected that measures of morphological awareness taken earlier on will predict consistency in the spelling of stems later, after controlling for differences explained by more general factors related to instruction (Grade) or general intelligence (IQ).

5.2 – PARTICIPANTS

There were 186 children in the study at the start. They came from two state-supported primary schools in the greater Lisbon area in Portugal. Children were seen three times.

In Session A (May 2001) they were on the last term of the first, second, and third grades (N = 186). In Session B (November 2001) they were on the first term of the second, third, and fourth grades (N = 185). In Session C (May 2002) they were on the third term of the second, third, and fourth grades (N = 184). The study lasted for one year.

In order to avoid subject mortality children who had been transferred to other schools between sessions, were identified, and their parents and new schools contacted. Whenever possible they were assessed in the new schools. Nine children had transferred schools between Sessions A and B, and two children between Sessions B and C. It was possible to locate eight of the nine children who changed schools in Session B and one of the two children in Session C. Thus, only two children were lost from the original sample. Therefore, this study reports data from 184 children from whom complete assessments were performed in Sessions A, B, and C. Table 5.1 displays the means and standard deviations for the ages of the participants in each cohort and session.

Table 5.1: Means and Standard Deviations (in brackets) of age of participants (in months) by Session and Cohort.

Cohorts			Session A (May 2001)	Session B (Nov. 2001)	Session C (May 2002)
Younger	N				
	64	M (SD)	83.25 (3.72)	89.31 (3.70)	95.31 (3.71)
Middle	61	M (SD)	95.72 (3.18)	101.72 (3.18)	107.72 (3.18)
Older	59	M (SD)	107.25 (3.63)	113.25 (3.63)	119.31 (3.64)

In the table, the children in the younger cohort are those that were at the end of the first grade in Session A, and then moved to grade two in Sessions B. In the last session they were about to finish grade two. Similarly, the children in the middle cohort were at the end of grade 2 in Session A, moved to grade 3 in Session B, and were about to finish this grade in Session C. Children in the older cohort were at the end of grade 3 at the beginning of the study. In the second session they were in the first term of grade 4, and were about to complete the fourth grade at the end of the study.

The sampling criteria were as detailed in the previous chapter.

5.3 – DESIGN

Children were assessed three times (Sessions A, B and C) on their awareness of morphology and on consistency in the spelling of stems. Session B took place 6 months after Session A and Session C, 12 months after Session A.

Awareness of morphology was assessed with three measures. The Word Analogy and Sentence Analogy tasks were repeated in the three sessions, and the Pseudo-word Interpretation Task, a new measure, was introduced in sessions B and C.

Consistency in spelling stems was assessed with a spelling task in the three sessions. It contained base and derived forms. In order to control for lexical knowledge the derived forms (whose spelling is not transparent) were spelled first, and the base forms (whose spelling is transparent) were spelled later. Lexical knowledge was further controlled, by matching the base forms with real derived words and with derived pseudo-words.

Spelling derived forms first assesses whether a correct spelling of the stem is possible in a non-transparent setting. However, one can not be sure that some stems of derived-

words have not been learnt by heart, simply as a function of lexical knowledge. Introducing pseudo-derived stimuli controls for such a possibility. Spelling non-transparent stems correctly in pseudo-derived stimuli is only possible if the child accesses the base morpheme of such stimuli and recognises a real stem there, despite the changes in its pronunciation.

In this design the outcome measures are Consistency in the Spelling of Stems of Base – Derived Words, and Consistency in the Spelling of Stems of Base – Pseudo-derived stimuli. The predictors are the three morphological awareness measures, Word Analogy, Sentence Analogy, and the Pseudo-word Interpretation Task. The latter measure was included in Sessions B and C in order to increase external validity by obtaining further information on morphological awareness, namely on processes related to the interpretation of base forms and affixes.

Grade and IQ were entered as covariates or control factors.

5.4 – MATERIALS AND PROCEDURE

5.4.1- The morphological awareness measures

Three morphological awareness measures were used: Word Analogy, Sentence Analogy and Pseudo-word Interpretation.

5.4.1.1 – The Word Analogy and Sentence Analogy Tasks

In Sessions A, B, and C children were assessed with the Word Analogy and Sentence Analogy tasks. These had the same items and were presented according to the procedures that were described in the previous chapter.

5.4.1.2 – The Pseudo-word Interpretation Task

The Pseudo-word Interpretation Task was designed according to a similar measure created by Nunes et al. (1997 a) and used in studies with English children.

This measure examines whether children can parse the constituent morphemes, stems and affixes, in a pseudo-word stimulus, access their independent meanings, and consider those together in order to interpret the ‘novel’ word. It measures children’s ability to access, recognise, and interpret morphemes.

Each stimulus is formed by morphemes that exist in the language, a stem and an affix, in a combination that does not form a word. This configuration controls for direct lexical access to the meaning of the stimulus. For example, in the pseudo-word ‘inalegre’, formed by a prefix ‘in-’ plus the stem ‘alegre’ (un + joyful), the child has to perform:

- 1) a correct parsing of the morphemes ‘in-’ + ‘alegre’;
- 2) access the meanings for the prefix (= negation) and the stem (= joyful) and then,
- 3) consider them together to produce a global meaning -‘não estar alegre’ (not being joyful).

The children were given four practice items, first. Two of these were formed by a stem plus a suffix (*Lisboeta*; *cãozinho*, meaning *someone from Lisbon* and *small dog*) and two were formed by a prefix followed by a stem (*supermercado*; *prosseguir*, meaning *supermarket* and *to continue*). The aim of introducing examples was to explain that words have different morphemes that can be recognised and that influence word meaning. For example, the children were told: ‘If we take the word ‘Lisboa’ and add ‘–

eta’ to it, what word will we have?’ The children answered ‘*Lisboeta*’ spontaneously, or with some prompting. Then the child was asked: ‘*What does Lisboeta mean?*’ If the expected answer was not provided, the experimenter helped the child to understand that ‘*Lisboa + -eta*’, makes ‘*Lisboeta*’, and that this new word means, ‘*someone who was born in Lisbon, or someone from Lisbon*’.

There were 20 experimental items in two sub-scales, organised of 10 items each. In each sub-scale the stems varied but the affixes were repeated. In sub-scale 1, the pseudo-word was presented without context. For example, the children were told: ‘*I am going to tell you a word that I invented. Desfeliz (dis + happy). If this word were to exist what would it mean? What would desfeliz mean?*’

In sub-scale 2, the stimuli were presented in a sentence context. Similarly to the above example, the child received the following instruction: ‘*I am going to read a sentence to you that contains a word that I invented – ‘Ela é muito desamável’ (she is really dis + nice). If this word, ‘desamável’, were to exist what would it mean? What would desamável mean?*’

Thus, two different stems, *feliz* (happy) and *amável* (nice) and the same prefix ‘*des-*’ (dis-) were presented either without or with sentence context.

Table 5.2 displays the items in the two sub-scales. The stems are presented in bold and the affixes in italics.

Table 5.2: Items of the **Pseudo-word Interpretation Task** presented without context and with sentence context.

Practice items:		Translation of explanation provided by (or given to) the child	
1 –	Lisboeta	Lisboa + <i>eta</i> means someone <i>who lives (was born) in Lisbon</i>	
2 –	Supermercado	<i>Super</i> + mercado means a <i>very big market</i>	
3 –	Cãozinho	Cão + <i>zinho</i> means a dog that is <i>small</i>	
4 –	Prosseguir	<i>Pro</i> + seguir , means to continue, to go on	
Experimental Items:			
Item	Sub-scale 1 No context	Sub-scale 2 Sentence context	Translation of expected answers from the child
1	Tesourador	Para construir uma casa preciso de um pedrador .	<i>Someone who works with:</i> 1) scissors ; 2) stone
2	Lapisaria	Quando for grande quero ter uma cadernaria .	<i>A shop where you buy (that sells):</i> 1) pencils ; 2) notebooks
3	Estrelista	O meu vizinho é um grande alhista .	<i>A person who knows about (studies, likes, observes):</i> 1) stars ; 2) garlic
4	Desfeliz	Ela é muito <i>desamável</i> .	Someone: 1) <i>unhappy</i> ; 2) <i>unkind</i>
5	Regritar	O coelho correu tanto que ficou <i>recansado</i> .	1) scream once more ; 2) to feel tired again
6	Copário	Gosto muito do que tenho guardado no meu doçário .	<i>A place to keep:</i> 1) glasses ; 2) sweets
7	Tachório	Se queres mais buracos no cinto tens que ir ao <i>furatório</i> .	<i>A place where:</i> 1) pans are manufactured; 2) you have your belts perforated
8	Inalegre	Ele comportava-se de uma forma <i>inatural</i> .	1) <i>not being joyful</i> ; 2) behaving <i>unnaturally</i>
9	Foguetãozeco	Com aquele tamanho, parece um <i>giganteco</i> .	1) <i>Small rocket</i> ; 2) <i>small giant</i>
10	Lunestre	O bacalhau é um ser <i>aquestre</i> .	1) <i>related to</i> (that lives on) the moon; 2) <i>lives on water</i>

No feedback was given in the experimental items. The affixes were in the same order in both lists. The items in sub-scale 1 (no-context) were presented first. The items in sub-scale 2 (sentence context) were presented immediately after.

Each child was seen individually in a quiet room. The whole task was performed orally, and the experimenter wrote down the answers. Each test item was repeated should the child provide no answer or when he or she requested it.

Children's answers were scored as correct (1) when an explanation that included the meanings of both the stem and the affix was provided. Examples of those answers are given in the third column of the above table (on the right). A score of (0) was given if only one morpheme was correctly recognised (for example, '*inalegre*' explained as '*alegre*' - 'joyful' and not as 'not being joyful'), or an unrelated answer was given. The minimum score was 0 and the maximum score was 20.

5.4.2- The spelling task

The spelling task was performed in Sessions A, B, and C. The 32 items assessing consistency in the spelling of stems were interspersed in a list of 96 stimuli (Appendix 4.1). This list was divided in two sub-lists of 48 stimuli that were presented on two consecutive days. Each list was presented in the same order to all children and contained words and pseudo-words.

In this chapter, only the 32 items assessing consistency in the spelling of stems are considered. Half of the stimuli were derived forms (16) and were spelled on the first day and the other half were base forms (16) that were spelled on the subsequent school day. The derived stimuli were further sub-divided into eight derived words formed by a real

stem plus a real suffix and eight pseudo-derived stimuli formed by a real stem plus a real suffix in a combination that does not exist. The stems in the base forms were phonologically transparent. The stems in the derived and pseudo-derived forms were not.

The scoring and procedure was the same as reported in the previous chapter.

5.4.3- Standardised measure

In Session A each child was seen individually in a quiet room and presented with a shortened version of WISC standardised for the Portuguese population by Marques (1970). This consisted of 4 sub-tests of each Verbal (Vocabulary, Digit Span, Similarities and Arithmetic) and Performance (Picture Completion, Picture Arrangement, Block Design and Object Assembly) IQ sub-scales.

The procedure was as detailed in the WISC Manual (Marques, 1970).

5.5 – RESULTS

5.5.1 – Analysis of Reliability

The first analysis examined whether the measures assessing consistency in the spelling of stems and morphological awareness were reliable. This analysis was necessary because instruments that have not been standardised were used.

In order to make this analysis, items' reliability was performed ($\text{Alpha} < .05$) in each session. According to Guilford & Fruchter (1973) '*the reliability of any set of measurements is logically defined as the proportion of their variance that is true variance*' (p. 397), once that there is a true measure and an error in any measurement. They also caution about the over-interpretation of the coefficient of correlation as an

abstract index of consistency of a measure. In fact, *‘one should speak of the reliability of a certain instrument applied to a certain population under certain conditions’* (p. 397).

As reported in the previous chapter, Alpha reliabilities of .84 for Consistency in the spelling of Stems in Base – Derived Words, of .83 for Consistency in the spelling of Stems in Base – Pseudo-derived Stimuli, of .71 for Word Analogy and of .86 for Sentence Analogy had been found in Session A.

Table 5.3 displays the results for the two measures assessing Consistency in the Spelling of Stems and the three morphological awareness measures, in Sessions B and C.

Table 5.3: Items’ Reliability (Alpha, $p < .05$) for Consistency in the Spelling of Stems and the three Morphological Awareness Measures, in Sessions B and C.

Measures	Number of Items	Session B	Session C
Consistency in Spelling Stems:			
- Base – Derived Words	16	.76	.67
- Base – Pseudo-derived stimuli	16	.72	.64
Morphological Awareness Measures:			
- Word Analogy	10	.75	.72
- Sentence Analogy	10	.85	.84
- Pseudo-word Interpretation	20	.78	.77

The results of this analysis provide evidence that the reliabilities for Consistency in the Spelling of Stems diminish as Session increases.

Reliabilities were around .80 in Session A, around .70 in Session B and around .60 in Session C. This reveals that greater variability is entered in children's answers as the study progresses. This is possibly related to the effect of schooling where improvement in the spelling of stems is an expected outcome and suggests that gains in consistency are not equally distributed in all participants. One can expect that as the number of items decreases so does reliability (Kline, 1993). This is the case here, for the two variables assessing Consistency in the Spelling of Stems, because reliability is computed separately. All Alphas are well above .7 when all the 32 items are analysed together. In fact, Alphas of .85 and of .80 are found in Sessions B and C, respectively, in the latter condition.

Reliabilities for the morphological awareness measures differ. They are lower, although within the limit of .70 proposed by Kline (1993) for Word Analogy and well above that limit for Sentence Analogy and the Pseudo-word Interpretation Task. The pattern is highly consistent for the latter two measures. No decrease is apparent across Sessions, possibly because no specific effect of schooling is expectable. In fact, the rationale of these measures is not the object of direct instruction.

Correlations in the morphological awareness measures ranging from .72 and .85 mean that the measures reflect between 52% and 72% of true variance, which is acceptable.

5.5.2 – Analysis of Skewness

The second analysis drew on whether the scores in each measure deviated from those expected in a normal distribution. This analysis is necessary because one wants to assess whether the data are normally distributed in order to decide whether to use parametric or non-parametric statistics. Most parametric statistics require that assumptions about normal distributions are met. However, this is the subject of an ongoing debate. It is

usually proposed that in longitudinal designs the outcome variables should be normally distributed, but that one can have either measurements or categorical variables as predictors, the latter, by definition, not normally shaped (Guilford & Fruchter, 1973).

An exam of whether the two outcome variables related to Consistency in the Spelling of Stems were normally distributed was performed. This ascertains that any predictions are not distorted by lack of symmetry in the outcome measures.

In the previous chapter, ‘z’ scores of 1.69 for Consistency in the Spelling of Stems in Base – Derived Words, of $z = 1.55$ for Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli were reported in Session A. Thus, the scores were not significantly skewed in the first session of the study. Z scores for the morphological awareness measures in Session A, $z = 1.99$ for Word Analogy and of $z = -.062$ for Sentence Analogy (after normalisation by square root), were also reported. The analyses of skewness in Sessions B and C are displayed in Table 5.4.

Table 5.4: Skewness (z) for Consistency in the Spelling of Stems and for the morphological awareness measures, in Sessions B and C.

	Session B	Session C
Outcome Measures:		
Consistency in spelling stems:		
- Base – Derived Words	2.56	1.28
- Base – Pseudo-derived Stimuli	2.13	1.09
Predictors:		
Word Analogy (WA)	-0.44	-2.73
Sentence Analogy (SA)	1.11	-2.99
Pseudo-word Interpretation (PWI)	-0.51	-0.69

According to Howitt & Cramer (1997) the scores in the outcome measures are slightly significantly skewed ($z > 1.96$) in Session B.

5.5.3 – Analysis by Normal Probability Plots

In order to examine whether it would be reasonable to assume normality, Normal Probability Plots were performed. These are displayed in Figure 5.1.

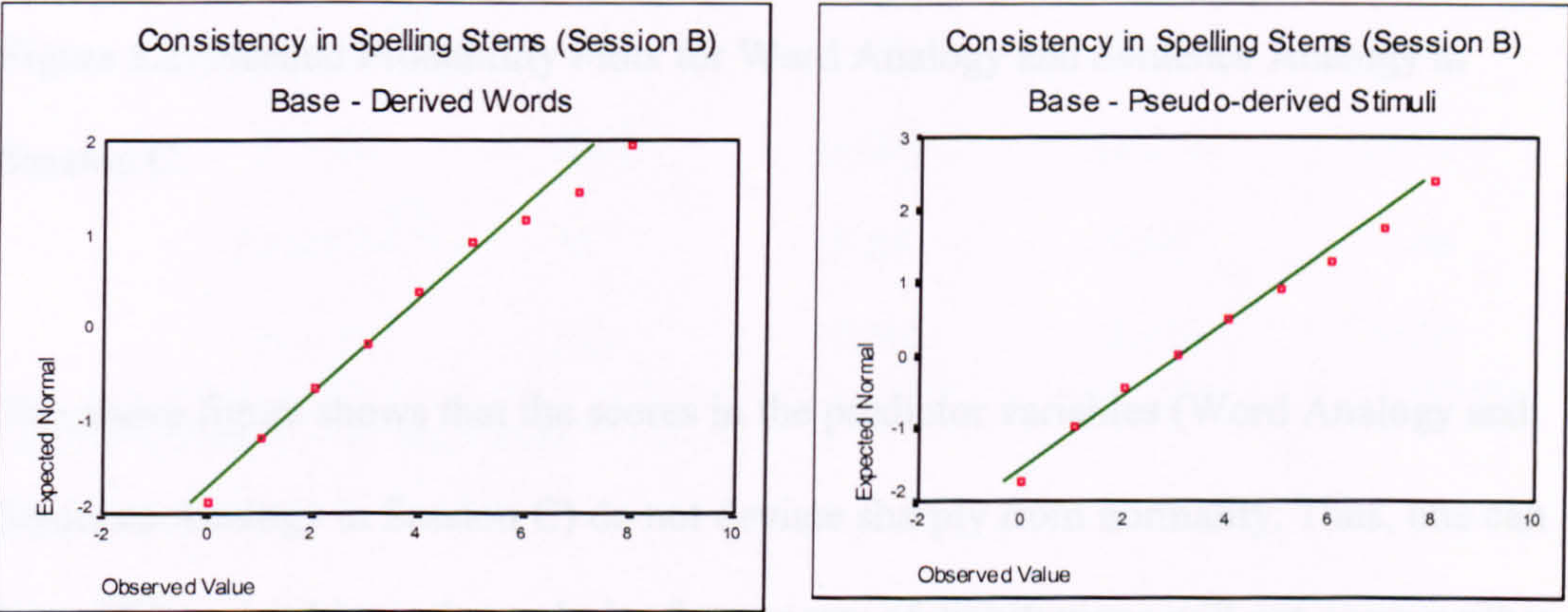


Figure 5.1: Normal probability Plots for Consistency in the spelling of Stems in Base – Derived Words and in Base – Pseudo-derived stimuli, in Session B.

The analysis of the plots suggests that the observed scores in Session B do not deviate sharply from those expected in a normal distribution. Because of this, normality is assumed in the following analyses. Thus, one has normally distributed scores for the outcome variables, in all sessions.

Skewness for the predictors that are significantly skewed is also included despite the fact that these variables do not need to be normally distributed. This is shown in Figure 5.2.

Table 5.5: Means and standard deviations (in brackets) for Word Analogy by Session and Grade

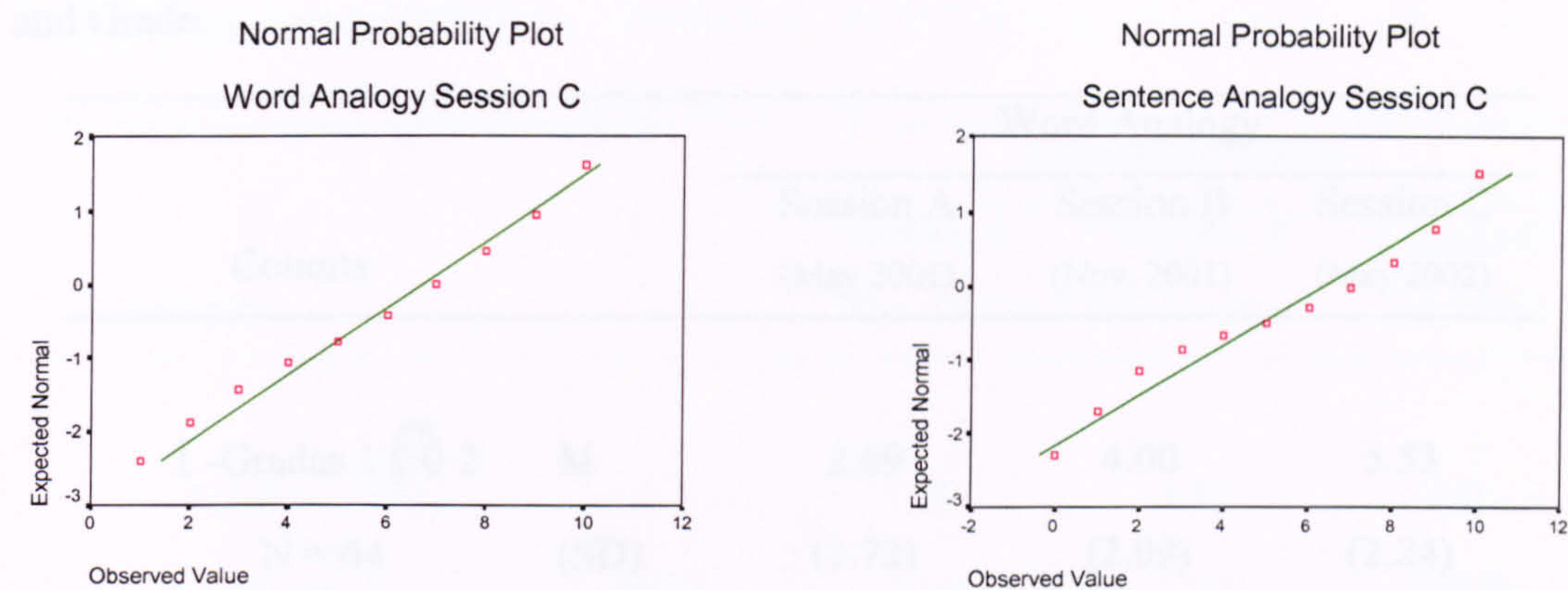


Figure 5.2: Normal Probability Plots for Word Analogy and Sentence Analogy in Session C.

The above figure shows that the scores in the predictor variables (Word Analogy and Sentence Analogy in Session C) do not deviate sharply from normality. Thus, one can be confident that biases due to lack of symmetry of distributions will not occur neither from the outcome nor from the predictor variables.

5.5.4 – Analysis of Means and Standard Deviations

Analysis of means and standard deviations were performed on the predictors and outcome variable followed by analysis of the significance of the mean differences.

Tables 5.5 through 5.7 display the means and standard deviations that were found in each of the morphological awareness measures, and in Consistency in the Spelling of Stems, by Session and Grade. For the purpose of comparability, the means found in Session A are also reported. In Table 5.5, the means and standard deviations for Word Analogy are displayed.

Table 5.5: Means and standard deviations (in brackets) for Word Analogy, by Session and Grade

Cohorts		Word Analogy		
		Session A (May 2001)	Session B (Nov. 2001)	Session C (May 2002)
1 -Grades 1 ↗ 2	M	2.69	4.00	5.53
N = 64	(SD)	(1.72)	(2.09)	(2.24)
2 - Grades 2 ↗ 3	M	4.33	5.98	7.12
N = 61	(SD)	(2.08)	(2.29)	(1.79)
3 - Grades 3 ↗ 4	M	5.59	6.69	7.66
N = 59	(SD	(2.36)	(2.23)	(2.00

Note: Minimum = 0; Maximum = 10

Table 5.5 shows that each cohort of children improved their ability to use Word Analogy as the study progressed. It should be noticed that children in the first cohort have higher mean scores in Session C than children in the second cohort in Session A, despite the fact that they were both at the end of Grade 2. Similarly, children in the second cohort in Session C reached higher mean scores than children in the third cohort in Session A, despite the fact that both groups were at the end of Grade 3. This might be due to a learning effect from the task, i.e., the repetition of the same task with a 6 months interval facilitated children’s performance.

Table 5.6 displays the means and standard deviations for the second task of morphological awareness, Sentence Analogy.

Table 5.6: Means and Standard Deviations (in brackets) for the Sentence Analogy Task, by Session and Grade

		Sentence Analogy		
		Session A	Session B	Session C
		(May 2001)	(Nov. 2001)	(May 2002)
Cohorts				
1 – Grades 1 ↷ 2	M	1.53	2.55	4.53
N = 64	(SD)	(1.39)	(1.95)	(2.92)
2 – Grades 2 ↷ 3	M	3.92	5.33	6.67
N = 61	(SD)	(2.69)	(2.71)	(2.44)
3 – Grades 3 ↷ 4	M	5.15	6.42	7.98
N = 59	(SD)	(3.08)	(2.76)	(2.21)

Note: Minimum = 0; Maximum = 10

The table shows that all cohorts improve their performance in Sentence Analogy across Sessions and that in each Session there is a similar improvement across Grades. The table also suggests that there was also a learning effect from the task when the performance in Session C in each cohort is compared with the performance of the following cohort in Session A.

Now, Table 5.7 displays the mean scores for the last measure of morphological awareness, the Pseudo-word Interpretation Task, that was used only in Sessions B and C.

Table 5.7: Means and Standard Deviations (in brackets) for the Pseudo-word Interpretation Task, by Session and Grade.




Cohorts		Pseudo-word Interpretation	
		Session B (Nov.2001)	Session C (May 2002)
1 – Grades 1 ↗ 2	M	6.48	8.82
N = 64	(SD)	(3.24)	(3.82)
2 – Grades 2 ↗ 3	M	9.21	11.42
N = 61	(SD)	(4.12)	(3.63)
3 – Grades 3 ↗ 4	M	11.51	12.95
N = 59	(SD)	(3.24)	(3.39)

Note: Minimum = 0; Maximum = 20.

The Table shows the same pattern as before. There is progress in the ability to recognise, interpret, and consider the meaning of stems and affixes in pseudo-word stimuli, in each cohort across sessions and in each session across cohorts. No learning effect from the task is apparent here.

The next two tables display the means and standard deviations for the outcome variables, Consistency in the Spelling of Stems in pairs of Base – Derived words (Table 5.8) and Consistency in the Spelling of Stems in pairs of Base – Pseudo-derived stimuli (Table 5.9).

Table 5.8: Means and Standard Deviations (in brackets) for Consistency in the Spelling of Stems in Base – Derived Words, by Session and Grade.

		Consistency in the Spelling of Stems in Base – Derived Words		
Cohorts		Session A (May 2001)	Session B (Nov. 2001)	Session C (May 2002)
1 – Grades 1  2	M	1.55	2.59	3.23
N = 64	(SD)	(1.33)	(1.40)	(1.22)
2 – Grades 2  3	M	3.11	3.10	4.03
N = 61	(SD)	(1.42)	(1.81)	(1.73)
3 – Grades 3  4	M	4.44	4.73	5.08
N = 59	(SD)	(1.64)	(2.07)	(1.98)

Notes: Minimum = 0; Maximum = 8;

This table shows that children improve their consistency in the spelling of stems across sessions and grades. Improvement from sessions A to B is smaller than from sessions B to C, especially for children in cohorts 2 and 3. Only at the end of Grade 3 (middle cohort in Session C) do children reach an above chance mean score.

Table 5.9 displays the means and standard deviations for Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli. In this configuration, the pseudo-derived stimuli are formed by a real stem and an affix, in a combination that does not exist in the language.

Table 5.9: Means and Standard Deviations (in brackets) for Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli, by Session and Grade

		Consistency in the Spelling of Stems in Base – Pseudo-derived Stimuli		
Cohorts		Session A (May 2001)	Session B (Nov. 2001)	Session C (May 2002)
1 - Grades 1 ↗ 2	M	1.89	2.13	2.92
N = 64	(SD)	(1.45)	(1.29)	(1.42)
2 - Grades 2 ↗ 3	M	2.84	3.25	4.28
N = 61	(SD)	(1.66)	(1.89)	(1.92)
3 - Grades 3 ↗ 4	M	3.88	4.00	4.98
N = 59	(SD)	(1.86)	(2.15)	(2.17)

Notes: Minimum = 0; Maximum = 8;

The table shows that there is an improvement with Session in the three cohorts. Above chance mean scores are also reached by children at the end of Grade 3 (middle cohort in Session C). Children in the middle cohort in Session C show a higher mean score than older children in the first two sessions. This may reflect a learning effect from the task but at the same time suggests that the bulk of consistency is achieved by the end of Grade 3 and that progress is rather difficult, thereafter.

5.5.5 – Analyses of significance of the mean differences

In order to examine whether there were significant differences in children’s performance on the predictors and on the outcome measures in the three sessions,

analyses of variance were conducted. One-way repeated measures ANOVA s (Sessions A, B and C) were performed in the mean scores of Word Analogy, Sentence Analogy and Consistency in the Spelling of Stems (Base – Derived Words and Base – Pseudo-derived stimuli). The effects of Session (Session B and C) for the Pseudo-word Interpretation Task were analysed with a paired samples t-test.

A significant effect of Session was found for the predictors, Word Analogy ($F(1, 183) = 342.35, p < .001$) and Sentence Analogy ($F(1, 183) = 251.66, p < .001$). Pairwise comparisons (Least Significant Difference, $p < .05$) revealed that children's performance in Session C was significantly higher than in Session B. Children's performance in Session B was also significantly higher than in Session A. A paired-samples t-test on the significance of the mean differences in the Pseudo-word Interpretation Task also showed that children's performance in Session C was significantly higher than in Session B ($t(183) = -10.09, p < .001$).

Significant effects of Session were also found in the outcome measures, Consistency in the Spelling of Stems in Base – Derived Words ($F(1, 183) = 69.70, p < .001$) and Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli ($F(1, 183) = 83.93, p < .001$). Again, pairwise comparisons (Least Significant Difference, $p < .05$) revealed that children's performance in Session C was significantly higher than in Session B. Children's performance in Session B was also significantly higher than in Session A.

The conclusion from these analyses is that performance, in either the predictors or outcome measures, improved significantly throughout the three sessions of the study.

5.5.6 - Analyses of predictive relations

The hypothesis in this study is that *there is a predictive relation between morphological awareness and improvement in consistency in the spelling of stems.*

The next analyses examine whether the scores in the outcome measures can be predicted from the scores in the morphological awareness measures, controlling for the effects of more general factors such as Grade and IQ.

Fixed order hierarchical multiple regressions were conducted analysing whether the scores in the outcome measures in Session B could be predicted from the scores in the two morphological awareness measures in Session A. Then, the analysis of whether the scores in the outcome measures in Session C could be predicted from the scores in the three morphological awareness measures in Session B was conducted. Finally, it was examined whether the scores in the outcome measures in Session C could be predicted from the scores in the two morphological awareness measures taken 12 months earlier, in Session A.

In each regression, the outcome measures were either Consistency in the Spelling of Stems in Base – Derived Words, or Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli. In all regressions, Grade and IQ were entered in the first and second steps, as control factors. This was done to ascertain that any predictive relations between morphological awareness and Consistency in Spelling Stems were specific and could not be explained by a third factor. In the third step, one of the morphological awareness measures was entered as a predictor.

Table 5.10 displays the results of the first two fixed order regressions analysing the relations between the morphological awareness measures in Session A and the outcome measure, Consistency in the Spelling of Stems in Base – Derived Words, in Session B.

Table 5.10: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Consistency in the Spelling of Stems in Base – Derived Words, in Session B

Outcome measure: Consistency in the Spelling of Stems in Base – Derived Words (Session B)					
Order entered (Session A)	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.192	1.06	.161	.438	.000***
2 – IQ	.075	.063	.015	.276	.000***
3.1 – WA	.000	.008	.075	.010	.910
3.2 - SA	.002	.043	.062	.062	.459

* p<.05; ** p<.01; *** p<.001

No evidence that Word Analogy or Sentence Analogy in Session A could predict Consistency in the Spelling of Stems in Base – Derived Words in Session B was found. The results indicate that Grade in Session A explains more unique variance (19 %) and is the best predictor of the outcome variable, followed by IQ.

Table 5.11 displays the results for the second outcome variable, Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli.

Table 5.11: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Consistency in the Spelling of Stems in **Base – Pseudo-derived** Stimuli, in Session B

Outcome measure: Consistency in the Spelling of Stems in Base – Pseudo-derived Stimuli (Session B)					
Order entered (Session A)	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.155	.940	.162	.394	.000***
2 – IQ	.054	.053	.015	.233	.001**
3.1 – WA	.010	.117	.077	.142	.130
3.2 - SA	.013	.104	.059	.153	.079

* p< .05; ** p< .01; *** p< .001

In these regressions, Grade and IQ account for 16 % and 5 % of unique variance. Both Word Analogy and Sentence Analogy account for 1 % of unique variance and the latter morphological awareness measure approaches significance (p = .079).

To conclude, no clear predictive relation was found between morphological awareness measured in Session A and Consistency in the Spelling of Stems measured six months later. Sentence Analogy approached significance in predicting Consistency in Base – Pseudo-derived stimuli, six months later.

The next series of fixed order multiple regressions examined whether morphological awareness in Session B could predict Consistency in the Spelling of Stems in Session C. Table 5.12 displays the results for Consistency in the Spelling of Stems in Base – Derived Words.

Table 5.12: Summary of three Fixed Order Hierarchical Multiple Regressions for Word Analogy, Sentence Analogy and the Pseudo-word Interpretation, all in Session B, Predicting Consistency in the Spelling of Stems in **Base – Derived Words**, in Session C.

Outcome measure: Consistency in the Spelling of Stems In Base – Derived Words (Session C)					
Order entered (Session B)	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.173	.923	.150	.416	.000***
2 – IQ	.030	.037	.014	.176	.009**
3.1 – WA	.014	.115	.064	.156	.076
3.2 – SA	.021	.126	.057	.207	.027*
3.3 – PWI	.029	.107	.041	.240	.010*

* p< .05; ** p< .01; *** p< .001

The Table shows that Grade explains approximately 17 % of the variance in all regressions and that IQ adds 3 % of significant variance. After controlling for Grade and IQ, all the three measures of morphological awareness still provide unique variance to the equation. The Pseudo-word Interpretation accounts on its own for 3 % more and the Sentence Analogy adds 2 %. Word Analogy accounts for 1 % of unique variance and this contribution approaches significance (p = .076).

Table 5.13 displays the results for Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli.

Table 5.13: Summary of Three Fixed Order Hierarchical Multiple Regressions for Word Analogy, Sentence Analogy and the Pseudo-word Interpretation, all in Session B, Predicting Consistency in the Spelling of Stems in Base – Pseudo-derived Stimuli, in Session C.

Outcome measure: Consistency in the Spelling of Stems In Base – Pseudo-derived Stimuli (Session C)					
Order entered (Session B)	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.174	1.04	.167	.417	.000***
2 – IQ	.008	.021	.016	.088	.197
3.1 – WA	.010	.110	.073	.133	.136
3.2 - SA	.024	.151	.064	.220	.020*
3.3 - PWI	.035	.131	.046	.264	.005**

p<.05; ** p<.01; *** p<.001

In these regressions, Grade accounts for 17 % of unique variance but IQ does not add any significant variance into the equation. The Pseudo-word Interpretation Task adds 4 % of significant variance and the Sentence Analogy Task also contributed with 2 % of unique variance. The Word Analogy was not significant. The fact that IQ is no longer significant in the spelling of Base – Pseudo-derived stimuli stresses the unique contribution of morphological awareness to the spelling, when lexical information is not available.

To conclude, there is consistent evidence that Consistency in the Spelling of Stems in Base – Derived Words, and in Base – Pseudo-derived stimuli in Session C can be significantly predicted from morphological awareness, measured six months earlier,

after controlling for unique variance explained by Grade and IQ. Both the Pseudo-word Interpretation and Sentence Analogy were found to significantly predict the level achieved by children in both the outcome measures.

Finally, the hypothesis that Consistency in the Spelling of Stems in Session C can be predicted from morphological awareness scores measured 12 months earlier is examined. First, the results for Consistency in Base – Derived Words are displayed in Table 5.14.

Table 5.14: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Consistency in the Spelling of Stems in **Base – Derived Words**, in Session C.

Outcome measure: Consistency in the Spelling of Stems In Base – Derived Words (Session C)					
Order entered (Session A)	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.173	.923	.150	.416	.000***
2 – IQ	.030	.037	.014	.176	.009**
3.1 – WA	.003	.063	.072	.082	.384
3.2 – SA	.002	.037	.055	.059	.505

* p<.05; ** p<.01; *** p<.001

Word Analogy and Sentence Analogy, measured in Session A failed to predict Consistency in the Spelling of Stems in Base – Derived Words in Session C. Only Grade and IQ explain significant unique variance in the regression equation.

The last series of fixed-order multiple regressions analyse whether the two morphological awareness measures in Session A predict the results for Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli, twelve months later.

Table 5.15: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Consistency in the Spelling of Stems in Base – Pseudo-derived Stimuli, in Session C.

Outcome measure: Consistency in the Spelling of Stems In Base – Pseudo-derived Stimuli (Session C)					
Order entered (Session A)	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.174	1.04	.167	.417	.000***
2 – IQ	.008	.021	.016	.088	.197
3.1 – WA	.018	.164	.081	.192	.044*
3.2 - SA	.022	.138	.062	.195	.027*

p< .05; ** p< .01; *** p< .001

It was found that both the Word Analogy and the Sentence Analogy accounted for significant unique variance predicting Consistency in the Spelling of Stems over a period of twelve months, after controlling for Grade and IQ differences. Grade, on its own, accounted for 17 % of unique variance. IQ did not add significant variance. After controlling for Grade and IQ, each one of the morphological awareness measures, Word Analogy and Sentence Analogy, added 2 % of unique variance to the equation.

To conclude, no evidence was found that morphological awareness, measured at the beginning of the study, could predict Consistency in the Spelling of Stems in Base – Derived Words at the end of the study. However, strong evidence was found that Word Analogy and Sentence Analogy, measured in Session A, could predict Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli twelve months later.

This suggests that children may rely mostly on previous spelling knowledge when spelling stems in base – derived words. However, when dealing with pseudo-word pairs, morphological awareness is a necessary tool to inform spelling choices.

5.5.7 – Summary of results:

1. There was a significant improvement across sessions of the longitudinal study in Consistency in the Spelling of Stems in Base – Derived words and in Base - Pseudo-derived stimuli.
2. There was a significant improvement across sessions of the longitudinal study in all measures of morphological awareness.
3. After controlling for the effects of Grade and IQ:
 - 3.1 - Word Analogy and Sentence Analogy in Session A failed to predict Consistency in the Spelling of Stems in Base – Derived Words in Session B.
 - 3.2 - Word Analogy in Session A failed to predict Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli in Session B, but Sentence Analogy approached significance.
 - 3.3 - Sentence Analogy and the Pseudo-word Interpretation tasks measured in Session B predicted Consistency in the Spelling of Stems in Base – Derived

words and in Base - Pseudo-derived stimuli in Session C. Word Analogy approached significance in the spelling of Stems in Base – Derived words but failed to predict Consistency in Base - Pseudo-derived stimuli.

3.4 - Word Analogy and Sentence Analogy measured in Session A failed to predict Consistency in the Spelling of Stems in Base – Derived words in Session C. However, both measures of morphological awareness in Session A significantly predicted Consistency in the Spelling of Stems in Base - Pseudo-derived stimuli twelve months later.

5.6 – DISCUSSION AND CONCLUSIONS

The results in this study support the hypothesis that morphological awareness is a significant and specific predictor of improvement in consistency in the spelling of stems.

After stringent controls for Grade and IQ, morphological awareness measures were found to predict Consistency in the Spelling of Stems over periods of six and twelve months.

Predictions from Sessions A to B were weak. The inclusion of first grade children in Session A depressed the means of the outcome and predictor variables. A period of summer holidays between the two sessions also shortened schooling time by two and a half months. Teachers usually refer that children tend to forget part of what they had learned during the summer holidays. Evidence for this was recently found by Melo (2002). Although the mean differences between Session A and B were significant in both the outcome and predictor variables, those differences were less pronounced than

between sessions B and C. This may explain why only Sentence Analogy in Session A approached significance in predicting Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli in Session B.

Sentence Analogy and the Pseudo-word Interpretation in Session B strongly predicted Consistency in the Spelling of Stems in Base – Derived words and in Base – Pseudo-derived stimuli, six months later.

Most importantly, Word Analogy and Sentence Analogy in Session A successfully predicted Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli twelve months later.

An interesting pattern emerged: Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli was more regularly predicted by morphological awareness measures than Consistency in the Spelling of Stems in Base – Derived Words. This strongly suggests that children accessed the morphological structure differently in pseudo-derived stimuli and in derived words. Pseudo-derived stimuli may have a more salient morphemic structure because they are formed by a real stem and a real suffix but are presented in a combination that does not exist in the language. This unexpected format may help the child to access the separate meaning of each morpheme. If stems are accessed separately from the suffix, they are pronounced transparently. Conversely, when spelling stems in derived-words children may find hard to access their stems separately from the suffixes because lexical knowledge for the whole word is readily available. If the derived word is accessed as a whole, the pronunciation of the stem morpheme is transformed by the presence of the suffix, therefore remaining non-transparent.

This study supports the findings in other alphabetic languages such as English (Carlisle, 1988; Nunes, 1998) and Greek (Aidinis, 1998) in that it takes time to develop enough skill to spell stems consistently. At the end of this study children in Grade 4 (nine-year-olds) spelled on average five out of eight pairs of stems consistently. This shows that there is still much improvement to be made in later grades. Similarly, Carlisle (1988) found that when stems require complex transformations, consistency is not yet fully achieved at the end of grade eight.

It is frequently claimed in Portuguese schools that accuracy in the spelling of words that are not transparent can only be achieved by systematic repetition exercises. Because the morphological link between words is scarcely explored children learn each word as a separate lexical entity with no relation to others. This study suggests that children develop awareness of morphological relations, and that such knowledge is strongly related to their ability to improve consistency six to twelve months later, after controlling for the main effects of Grade and IQ.

More research is needed to replicate these findings. Intervention studies with a special focus on morphology are also needed to examine whether a morphological route would prove more effective than the usual teaching practices.

Although evidence in support of a predictive link between morphological awareness and consistency in the spelling has been obtained both concurrently (previous chapter) and longitudinally, caution should be taken, for several reasons. Firstly, they provide first evidence in a new language, Portuguese, and it is necessary to get additional evidence confirming that such a trend exist. The second reason is that, although a longitudinal design has been used, the length of time covered is relatively short (twelve months). Studies examining children's spelling processes over longer periods are needed. Thirdly, more information is necessary on when morphological spelling strategies are

fully achieved. This involves samples with children in even higher grades. Finally, because all morphological awareness measures were adapted for the purpose of this study, their validity must undergo testing in other studies and by other researchers.

Chapter 6

Study 4 - Morphological Awareness and

Discrimination of ‘-esa’ / ‘-eza’ Homophone Suffixes: Longitudinal Study

6.1 – RATIONALE

The aim of this study is to examine the hypothesis that there is a predictive relation between morphological awareness and the development of discrimination in the spelling of words and pseudo-words ending in the homophone suffixes ‘-esa’ / ‘-eza’.

It should be remembered that these suffixes are pronounced in exactly the same way but spelled differently. The discrimination of their spelling can only be based on knowledge about how each suffix transforms the base word. The suffix ‘-esa’ is the feminine inflection of the derivational suffix ‘-ês’ that forms nouns indicating belonging, provenance, ethnical or social origin (e.g., ‘camponês’, ‘camponesa’, meaning, ‘a rural worker’, in the masculine and feminine forms, respectively). The suffix ‘-eza’ is a derivational suffix that transforms nouns, or adjectives (e.g., ‘belo’, meaning ‘beautiful’) into abstract nouns (‘beleza’, meaning ‘beauty’).

Chapter 4 examined whether there was a specific relation between morphological awareness and the spelling of these homophone suffixes, taking into consideration the concurrent relations in Session A of the longitudinal study. It was found that Sentence Analogy significantly predicted the level of discrimination in the spelling of ‘-esa’/ ‘-eza’ words and pseudo-words, after controlling for Grade and IQ differences.

In this chapter this relation is investigated longitudinally. It is expected that a longitudinal analysis will add power to the concurrent findings, i.e., that predictive relations are found

between morphological awareness measured in earlier sessions and Discrimination in the Spelling of Homophone Suffixes ‘-esa / ‘-eza’, measured later.

Data from three sessions, covering a period of 12 months, will be analysed.

Two types of quantitative analyses will be performed on the data.

Firstly, the scores will be examined as *categories*, looking at whether a spelling model, summarised by Bryant, (2002) is adequate to describe the Portuguese data. According to Bryant (2002):

1) initially, younger children tend to select only one spelling pattern, when more than one could apply; 2) then, they start to understand that there are exceptions and introduce alternative patterns but are unable to assign them systematically to the right contexts; 3) eventually they start to assign the alternative spellings systematically. This model was first established in a longitudinal study with English children by Nunes et al. (1997 a, b), and since then, other studies in Greek (Aidinis, 1998) and French (Fayol et al, 1999) have confirmed it.

Secondly, the scores will be examined as a *continuous variable* looking at the amount of progress in discrimination, and at whether morphological awareness measures taken earlier in the study predict discrimination in later assessments. This would be evidence that morphological awareness is one of the foundations of knowledge required to discriminate the spelling of homophone suffixes.

Three hypotheses are tested in this study. The first relates to the analysis of the categorical data or phases of spelling. The remaining two relate to the analysis of the continuous scores.

Hypotheses:

1 – Correct assignment in the spelling the homophone suffixes ‘-esa’ / ‘-eza’ will follow a series of developmental phases: younger children will first tend to use only one spelling pattern for the two suffixes; this is followed by the use of alternative patterns without systematic assignment, and by a phase in which systematic assignment is achieved.

2 – There is a progression in the ability to use discrimination in the spelling of ‘-esa’ – ‘-eza’ homophone suffixes.

3 - There is a predictive relation between morphological awareness and discrimination of homophone suffixes ‘-esa’- ‘-eza’, which cannot be explained by individual differences in level of instruction or general intelligence.

6.2 – PARTICIPANTS

The participants were the same 184 children as described in the previous chapter. This data set is part of the same longitudinal study as described previously now focusing only on the analysis of discrimination of the homophone suffixes ‘-esa’ / ‘-eza’.

For further details about the participants, their age, and sampling procedure, please refer to Chapter 4.

6.3 – DESIGN

Children were assessed three times (Sessions A, B and C) on their awareness of morphology, and on discrimination in the spelling of words and pseudo-words ending in

the homophone suffixes ‘-esa’ – ‘-eza’. Session B took place 6 months after Session A and Session C 12 months later than Session A.

Awareness of morphology was assessed with three measures. The Word Analogy and Sentence Analogy tasks were repeated in the three sessions, and a new measure, the Pseudo-word Interpretation Task, was introduced in sessions B and C.

Discrimination in the Spelling of ‘-esa’ / ‘-eza’ Homophone Suffixes was assessed with a spelling task in the three sessions. It contained words and pseudo-words. Pseudo-words were used to provide control for lexical knowledge. Pseudo-words have also the aim to analyse whether a morphological rule is accessed in the absence of lexical knowledge.

In this design, the outcome measures are Discrimination in the Spelling of Words ending in the homophone suffixes ‘-esa’ – ‘-eza’, and Discrimination in the Spelling of Pseudo-words ending in the homophone suffixes ‘-esa’ – ‘-eza’. The predictors are the three morphological awareness measures, Word Analogy, Sentence Analogy and the Pseudo-word Interpretation tasks. Grade and IQ were entered as covariates or control factors.

6.4 – MATERIALS AND PROCEDURE

6.4.1 – The morphological awareness measures

Three tasks designed to assess morphological awareness were used: Word Analogy, Sentence Analogy and the Pseudo-word Interpretation. The first two measures were described in detail in Chapter 4. The third measure was described in detail in Chapter 5.

6.4.2 – The spelling task

The spelling task was performed in Sessions A, B, and C. There were 32 items assessing discrimination in the spelling of ‘-esa’ / ‘-eza’ homophone suffixes. There were 8 words and 8 pseudo-words assessing the spelling of the suffix ‘-esa’ and 8 words and 8 pseudo-words for the suffix ‘-eza’. These items were interspersed in a list of 96 stimuli (Appendix 4.1). This list was divided in two sub-lists of 48 stimuli that were presented on two consecutive days. Each list was presented in the same order to all children and contained words and pseudo-words. The stimuli were presented orally by the experimenter in a sentence context.

If sentence context was not provided it would be impossible to determine the grammatical status of the pseudo-words and therefore, no spelling choice was possible. The procedure was the same as reported in the previous chapter.

6.4.3 – The standardised measure

In Session A each child was seen individually in a quiet room and presented with a shortened version of WISC standardised for the Portuguese population by Marques (1970). This consisted of four sub-tests of each Verbal (Vocabulary, Digit Span, Similarities and Arithmetic) and Performance (Picture Completion, Picture Arrangement, Block Design and Object Assembly) IQ sub-scales.

The procedure was as detailed in the WISC Manual (Marques, 1970).

6.5 – RESULTS

6.5.1 – Analyses of scores as categories: the spelling model

This analysis aims to examine whether a spelling model proposed by Nunes et al. (1997 a) is suitable to examine Portuguese children's spellings of '-esa'/'-eza' homophone suffixes.

6.5.1.1 – Scoring

Spellings in each suffix were classified as morphologically correct, phonologically acceptable but incorrect, and non-phonological.

Morphologically correct spellings were those in which the suffix was spelled according to grammar, thus correct, e.g., [esa] for '-esa', [eza] for '-eza'.

Phonologically acceptable but incorrect spellings were those that were not grammatical but had acceptable phonological representations for the sounds in the suffix, e.g., [eza] for '-esa', [esa] for '-eza'.

Non-phonological spellings were all those spellings which did not adequately represent the sounds of the suffixes, e.g., [es] for '-esa', [eja] for '-eza'.

The number of occurrences of morphologically correct, phonologically acceptable but incorrect, and non-phonological spellings was counted and these variables were used to compute a model with four phases. Phases 2, 3, and 4 correspond to the model proposed in Nunes et al. (1997 a, b) and summarised in Bryant (2002). Phase 1, pre-phonetic, had to be introduced because one third of children in Session A were first graders and some of them were still going through basic learning of sound-letter correspondences.

6.5.1.2 – Criteria to devise phases of spelling

Strict achievement criteria were defined to devise the phases in the spelling model following those used in the longitudinal study by Nunes et al.(1997 a). Four phases were devised and tested longitudinally.

Phase 1: Pre-phonetic – To be classified in this phase *less than 9 out of 16* spellings are sensible representations for the suffixes. Sensible spellings are all those that are either morphologically correct, or phonologically acceptable but incorrect. For example, the child uses mostly non-sensical spellings such as [eca] or [eja] to represent the suffixes ‘-esa’ or ‘-eza’.

Phase 2: One Pattern Only – For a child to be classified in this phase it is necessary to show that the previous one was overcome. Thus, *more than 8 out of 16* spellings are sensible, and the child uses one form of spelling for both homophone suffixes up to 14 out of 16 times. This means that an alternative spelling cannot be found to occur more than twice. For example, the child spells the morphemes ‘-esa’ and ‘-eza’ as [esa] at least 14 times out of 16.

Phase 3: Two Patterns Unsystematic - *More than 8 out of 16* spellings are sensible and the child uses two patterns of spelling. To be considered a two-pattern user each of these two patterns must be observed at least 3 times. Each spelling pattern can be correctly assigned or not to the corresponding suffix. When the assignment is correct, it should stay below the level that is considered systematic (7 out of 8 correct in each suffix, as in the next phase). When the assignment is not correct, any number higher than 2 is accepted. For example, the child uses any number higher than 2 and lower than 7 of [esa]

and [eza] to spell ‘-esa’ and ‘-eza’, respectively (correct assignment), or any number of spellings above 2 of [esa] and [eza] for the suffixes ‘-eza’ and ‘-esa’ (non-correct assignment).

Phase 4: Two Patterns Systematic - The child assigns morphologically correct spellings for each of the two homophone suffixes at least 7 out of 8 times. This means that the suffix ‘-esa’ is spelled morphologically as [esa] at least 7 out of 8 times, and the suffix ‘-eza’ is also spelled morphologically as [eza] at least 7 out of 8 times.

The spelling phase that each child used in each session was computed, either for the spelling of ‘-esa’ / ‘-eza’ words, or for ‘-esa’ / ‘-eza’ pseudo-words, using the above criteria. The computation was based on a SPSS syntax algorithm, containing a set of statistical instructions, based on the above criteria. This assures that the coding in the different sessions is not biased by judgement differences.

6.5.1.3 – Frequencies of phases of spelling

It was hypothesised that *correct assignment in the spelling of ‘-esa’ / ‘-eza’ homophone suffixes will follow a set of developmental phases: younger children will tend to use one pattern only for the two suffixes; this is followed by the use of alternative patterns without systematic assignment; eventually, systematic assignment is achieved.*

In order to examine the above hypothesis, analysis of the number of children that entered each spelling phase was performed first. This analysis was followed by correlations assessing the relation between spelling phases and age, and by comparisons of the relative positions in the use of spelling phases at the beginning and at the end of the study.

Tables 6.1 and 6.2 present the number of children that used a certain spelling phase to spell the homophone suffixes ‘-esa’ / ‘-eza’, in words and pseudo-words, across Sessions and Grades.

Table 6.1: Frequencies of phases of spelling for ‘-esa’ / ‘-eza’ words by Session and Grade

	Session A			Session B			Session C		
	(May 2001)			(Nov. 2001)			(May 2002)		
	Grades			Grades			Grades		
	1	2	3	2	3	4	2	3	4
N	64	61	59	64	61	59	64	61	59
Phases of spelling:									
Pre-phonetic	16	3	-	3	2	-	-	-	-
One-pattern-only	38	21	23	38	24	16	35	21	11
Two-unsystematic	10	36	34	23	34	39	29	38	41
Two-systematic	-	1	2	-	1	4	-	2	7

This table shows that those children that use pre-phonetic spellings are mainly first graders. This is an indication that these children are still attempting to master basic sound-letter conventions in Session A, at the end of Grade 1. In the suffixes ‘-esa’/ ‘-eza’ the major issue is the representation of the middle sound /z/, that can take the forms of [s], [z], or rarely [x]. The above table shows that most children are already using phonologically acceptable representations. Pre-phonetic spellers have not yet mastered these

representations, and attempts to represent the sound /z/ with phonologically unacceptable forms such as [j], [ch], [dj], still occur. Pre-phonetic spellings become rare after Grade 1. The second issue in the above table is that the number of children that use one-pattern-only to spell both suffixes tends to decrease as grade increases. This is an indication that younger children try to accommodate to the spelling issues using a simplified strategy and drop this approach as they realise, through schooling, that the sound /z/ can be represented in more than one way. This is why the number of children that use two-patterns-unsystematically increases as the previous pattern decreases. Finally, a few children in Grades 3 and 4 reach systematic assignment, i.e., use morphological spellings in each of the suffixes.

The next table presents the frequencies for ‘-esa’ / ‘-eza’ pseudo-words.

Table 6.2: Frequencies of phases of spelling for ‘-esa’ / ‘-eza’ pseudo-words by Session and Grade

	Session A			Session B			Session C		
	(May 2001)			(Nov. 2001)			(May 2002)		
	Grades			Grades			Grades		
	1	2	3	2	3	4	2	3	4
N =	64	61	59	64	61	59	64	61	59
Phases of spelling:									
Pre-phonetic	18	3	1	3	1	1	1	1	-
One-pattern-only	35	35	35	39	34	25	41	31	25
Two-unsystematic	11	23	23	22	26	33	22	29	34
Two-systematic	-	-	-	-	-	-	-	-	-

Table 6.2 also shows that pre-phonetic spellings tend to disappear after Grade 1. These spellings may just reflect lack of experience and a still tentative learning of which letters go with which sounds, in the younger children. With the exception of Session A, the frequency of one-pattern-only users tends to decrease as grade increases. Two-unsystematic-pattern users tend to increase as grade increases. No children reached the last phase of the spelling model, the systematic assignment of the suffixes. Thus, this analysis seems to point to a trend suggesting that a developmental model, similar to what has been proposed in the literature (Bryant, 2002; Fayol et al, 1999; Nunes et al., 1997 a, b), is partly followed when Portuguese children attempt to spell homophone suffixes. After mastering basic phonetic conventions, younger children tend to use one pattern only for the two suffixes. This trend decreases as they grow older. Conversely, as the number of one-pattern-users decreases the number of children that started to notice exceptions, therefore using more than one spelling pattern, increases. The number of children that reach a systematic assignment is surprisingly low. Systematic assignment is probably influenced by lexical knowledge, since no children achieved that phase when spelling pseudo-words.

6.5.1.4 – The test of the spelling model

Nunes et al. (1997 a) proposed that a phase model should pass at least three tests. According to Nunes, et al., (1997 a) the first test “ *is that all, or very nearly all, the children should clearly belong to one of the stages in each session* ” (...) The second test is that “ *the developmental stages should be related to developmental criteria: The children at more advanced stages should be the older or the educationally more successful children in the sample. The third test is the most stringent and, unfortunately, the least often*

applied. Because the stages are ordered from less to more advanced, over time, individual children should move in one direction but not in the other. If a child is at Stage 2 in one session, the model predicts that he or she will be either at Stage 2 or at Stages 3, 4 or 5 in the next session but not at Stage 1” (p. 642).

Now, evidence on how the present data fit these three tests will be presented.

By definition the criteria that defines each of the phases leaves no child unclassified. Thus, the first test is met. As for the second test, a positive correlation should be found between phases of spelling and children’s age. This would be evidence that younger children are at earlier phases of spelling and that older children use spellings that are characteristic of more advanced phases.

Table 6.3 shows the correlations between spelling phases and age that were found. Positive correlations would mean that the higher the spelling phases (from 1 = Pre-phonetic to 4 = systematic assignment) the higher the age (in months).

Table 6.3: Pearson Correlations between Age in Sessions A, B and C and Phases of Spelling of ‘-esa’ / ‘-eza’ words and pseudo-words.

	Phases of Spelling	
	‘-esa’ / ‘-eza’ Words	‘-esa’ / ‘-eza’ Pseudo-words
Age Session A	.43***	.33***
Age Session B	.35***	.16*
Age Session C	.31***	.20**

Notes: *** p<. 001; ** p<. 01; * p<. 05

This table provides evidence for the second test of the phase model. The significant positive correlations that were found clearly suggest that there is an age trend in the spelling phases. This confirms that the older the children are the more likely they will be using spelling strategies that are more advanced in the phase model. The lower although significant correlations in Session B and C in the spelling of Pseudo-words suggest that more variance in this relation might be explained by other factors.

In order to answer the third test that most children should progress in the spelling phases, cross-tabulations of phases of spelling comparing the relative positions of children in Session A with their positions in Session C were performed.

Session B was not entered in this comparison because the 6 months separating Sessions A and B do not reflect an equivalent length of schooling when compared to Sessions B and C. This was because children went through a period of summer holidays (two and a half months) between Sessions A and B, and this was responsible for less achievement when compared to the 6 months separating Sessions B and C. Because of this, phase changes over the whole length of the study (12 months) comparing Sessions A and C were examined. This represents the development that children did from the end of the school year they were in when the study started until the end of the next school year.

In Nunes et al.'s (1997 a) longitudinal study, the researchers report comparisons between Sessions A and B, separated by 7 months and between Sessions B and C, separated by 13 months. It may be the case that different lengths of time provide us with a more reasonable perspective of which time length it is reasonable to expect genuine developmental change. The floor effects in the systematic assignment of these suffixes strongly suggest that these spelling issues are rather difficult to master, and therefore it might be reasonable to look for developmental changes over longer periods.

The next tables present those phase changes for the spelling of ‘-esa’/ ‘-eza’ words (Table 6.4) and pseudo-words (Table 6.5).

Table 6.4: Crosstabulation of phases of spelling between Sessions A and C, in ‘-esa’ / ‘-eza’ Words.

	'-esa' / '-eza' Words				Total (A)
	Phases in Session C				
	1	2	3	4	
Phases in Session A					
1 - Pre-phonetic	0	8	11	0	19
2 - One-pattern only	0	38	43	1	82
3 - Two-unsystematic	0	21	53	6	80
4 - Two-systematic	0	0	1	2	3
Total (C)	0	67	108	9	184

The numbers in the diagonal (in bold) refer to those children that stayed in the same phase across sessions (50.5 %). Above that line are the children that progressed one or more phases (37.5 %). Below, are the children that regressed to the previous phase (12 %).

The pattern here is quite clear. None of the 19 pre-phonetic children in Session A were in the same phase a year later. The majority of them advanced by more than one phase.

Approximately half of the 82 children that in Session A were one-pattern users progressed at least one phase in Session C. There were also 80 children that at the beginning of the study used two different patterns, unsystematically. The majority of them stayed in the same phase; 6 achieved full systematic assignment and some regressed to the previous

phase. Finally, more children were systematically correct in Session C when compared to Session A, although the numbers are small.

Table 6.5 displays the cross-tabulation of phases of spelling between Sessions A and C, in the spelling of ‘-esa’ / ‘-eza’ pseudo-words.

Table 6.5: Crosstabulation of phases of spelling between Sessions A and C, in ‘-esa’ / ‘-eza’ Pseudo-words

	‘-esa’ / ‘-eza’ Pseudo-Words				Total (A)
	Phases in Session C				
	1	2	3	4	
Phases in Session A					
1 - Pre-phonetic	0	17	5	0	22
2 - One-pattern only	2	57	46	0	105
3 - Two-unsystematic	0	23	34	0	57
4 - Two-systematic	0	0	0	0	0
Total (C)	2	97	85	0	184

Overall, there are 49.6 % of children who stayed in the same phase, 36.9 % who progressed to higher phases and 13.6 % who regressed to a lower phase. Thus, the move is in the right direction too, although no children achieved systematic assignment. There were 22 children in Session A that were pre-phonetic. Only 2 remained in that phase one year later. In the intermediary phases 2 and 3 fewer one-pattern-only spellers and more two-unsystematic spellers are found in Session C when compared with Session A.

The analysis done for ‘-esa’ / ‘-eza’ words and pseudo-words shows a sharp similarity of processes. A similar amount of those who stayed, progressed or regressed in spelling phases was found. The model does not provide an explanation for why some children regressed.

To conclude, the model of spelling phases that was tested with Portuguese children exemplifies the sort of developmental trend that has found support in different languages (Aidinis, 1998; Nunes, et al., 1997 a; Fayol et al., 1999). These phases correlate significantly and positively with age and more children progressed or stayed in the same phase than regressed. This analysis does not provide enough evidence for when children reach the last phase because only a small number of children achieved a systematic discrimination of the homophone suffixes ‘-esa’ / ‘-eza’, in words.

6.5.2 – Analyses of scores as continuous variables: spelling discrimination

6.5.2.1 – Scoring

The spellings were scored as correct (1), or incorrect (0). Correct scores were those in which the only one acceptable morphological spelling for each morpheme ‘-esa’ and ‘-eza’ was fully respected. All other representations, even if phonologically acceptable, were scored as incorrect.

After calculating the number correct and incorrect, each child’s score was transformed into a discrimination score corrected for chance, using Guilford’s formula, $S = R - (W/n-1)$ (Guilford, 1954).

In this formula, S is the discrimination score, R is the number of right answers, W is the number of wrong answers and n is the number of spelling possibilities, a score that represents the amount of discrimination and that is, at the same time, corrected for chance,

is obtained. This gives a distribution of scores with a middle value of 0 (zero) meaning that the amount correct equals the amount incorrect. Because there are 8 possible correct spellings for each suffix, the extreme positive value is +16 (both suffixes systematically discriminated) and the extreme negative value is –16 (no discrimination because both suffixes are systematically wrong). Negative scores indicate that discrimination is systematically wrong, and positive scores indicate progress towards a systematic correct discrimination. The reasons why this method was used are detailed in Chapter 4.

6.5.2.2 – Analyses of reliability and skewness

The results for the reliability found in Session A were already reported in Chapter 4. Those indicated an Alpha of .80 for Discrimination in the Spelling of Words ending in the Homophone Suffixes ‘-esa’/ ‘-eza’ and of .83 for Discrimination in the Spelling of Pseudo-words. Table 6.6 displays, now, the results for items’ reliability in Sessions B and C.

Table 6.6: Items’ Reliability (Alpha, $p < .05$) for Discrimination in the Spelling of Words and Pseudo-words ending in the Homophone Suffixes ‘-esa’/ ‘-eza’, in Sessions B and C.

Measures	Number of Items	Session B	Session C
Discrimination of homophone suffixes:			
- ‘-esa’/ ‘-eza’ Words	16	.60	.47
- ‘-esa’/ ‘-eza’ Pseudo-words	16	.75	.49

The above table shows a sharp fall in internal consistency of the measure when compared to what had been found in Session A. In Discrimination of ‘-esa’/ ‘-eza’ Words the alphas

drop from .80 in Session A, to .60, and .47, in sessions B and C. The same tendency appeared in discrimination of pseudo-words, in which the Alphas drop from .83 in Session A, to .75, and .49, in sessions B and C. This is an indication that more internal variability was introduced in the latter sessions with a wider range of spelling patterns being used. Thus, this drop in reliability is indicative that children are changing their spelling patterns, and that different groups of children are going in different directions, or using patterns that are not consistent across sessions.

As for the analysis of skewness, a $z = 0.05$ and $z = 0.08$ had been found, in Session A, for discrimination in the spelling of Words and Pseudo-words, respectively, after normalisation by the Rank Normal Blom method. Table 6.7 displays the results for skewness in Sessions B and C.

Table 6.7: Skewness (z) for Discrimination in the Spelling of Words and Pseudo-words ending in the Homophone Suffixes ‘-esa’/ ‘-eza’, in Sessions B and C.

	Session B	Session C
Discrimination of homophone suffixes:		
- ‘-esa’/ ‘-eza’ Words	1.18	0.96
- ‘-esa’/ ‘-eza’ Pseudo-words	-3.94(a)	0.06

Note: (a) $z = -.020$, after normalisation by the Rank Normalise Blom method.

The table shows that the outcome measures are not significantly skewed except for ‘-esa’/ ‘-eza’ Pseudo-words. The latter variable was successfully normalised by the Rank Normalise Blom (1958) method.

6.5.2.3 – Analyses by Normal Probability Plots

In order to examine whether the observed scores of Discrimination of ‘-esa’/ ‘-eza’ Pseudo-words in Session B deviated sharply from what should be expected in a normal distribution, a Normal probability Plot was conducted. This is shown in Figure 6.1.

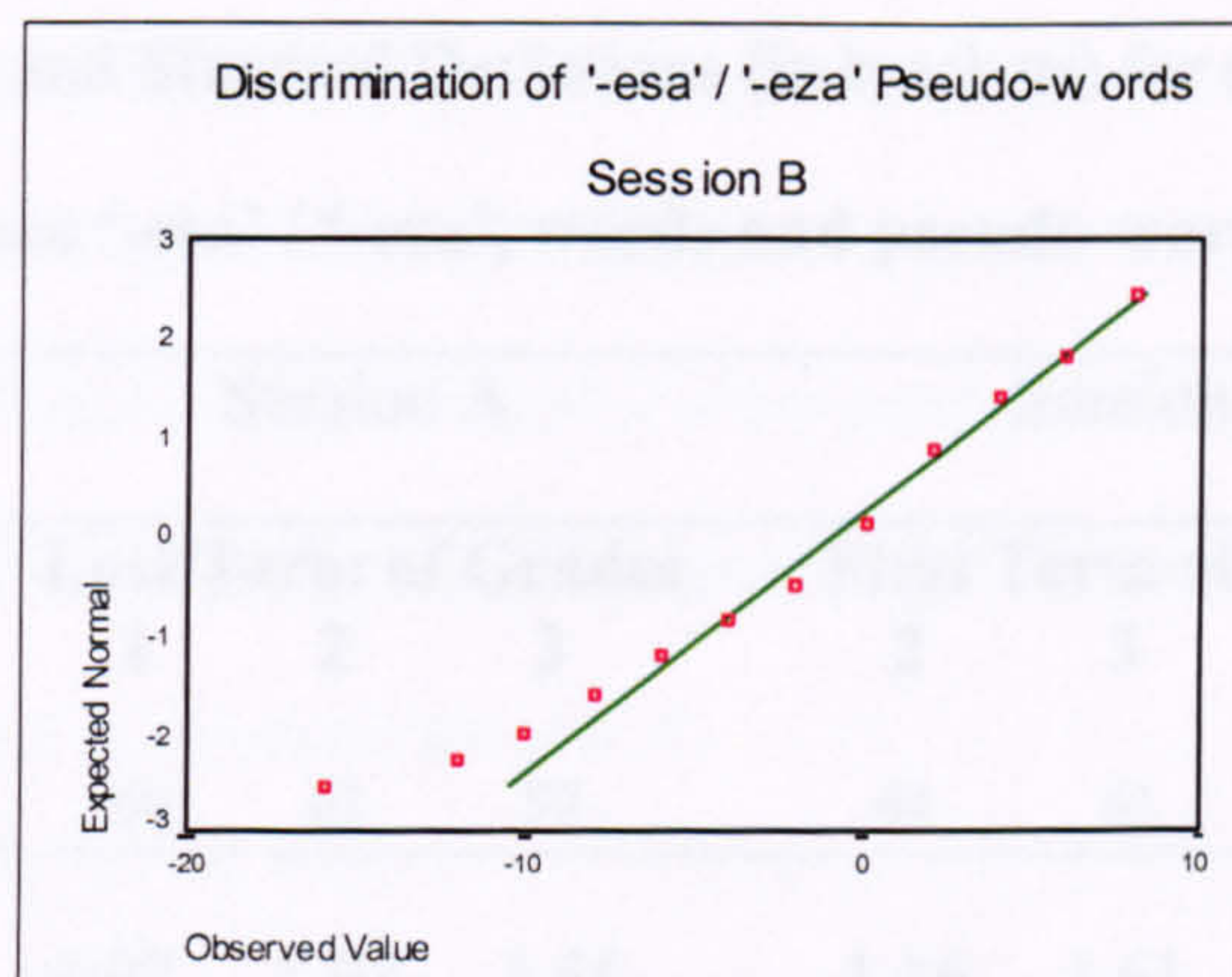


Figure 6.1: Normal Probability Plot for Discrimination in the Spelling of Pseudo-words ending in the homophone suffixes ‘-esa’/ ‘-eza’, in Session B.

The plot shows that the observed and expected scores cluster nicely around a straight line. The only exceptions are some scores in the extreme low discrimination range. An inspection of the data revealed that there were two children in Session B that got –16 and –12, respectively, in discrimination of ‘-esa’/ ‘-eza’ pseudo-words. Both children were at the beginning of the second grade, and were still pre-phonetic spellers and because of that used a systematic wrong approach to the spelling of the suffixes.

Results for the reliability and skewness of the morphological awareness measures are not repeated because they were already reported in the previous chapter.

6.5.2.4 – Analysis of means and standard deviations

The next analysis examined whether children improved their spelling as the study progressed, and whether the mean differences were significant.

Table 6.8 displays the means, and standard deviations, that were found by Session and Grade.

Table 6.8: Means and Standard Deviations (in brackets) for discrimination in the homophone suffixes ‘-esa’ / ‘-eza’, words and pseudo-words, by Session and Grade

	Session A			Session B			Session C		
	Last Term of Grades			First Term of Grades			Last Term of Grades		
	1	2	3	2	3	4	2	3	4
N =	64	61	59	64	61	59	64	61	59
Words	-3.97 (6.07)	1.02 (4.97)	3.56 (4.17)	-1.16 (3.98)	1.61 (4.22)	5.22 (4.10)	.75 (3.86)	3.87 (4.56)	6.34 (4.20)
Pseudo-words	-4.38 (6.14)	-.75 (3.67)	-1.22 (3.34)	-.75 (4.15)	-.72 (3.72)	-.98 (3.53)	-.53 (2.99)	-1.08 (3.05)	-.24 (3.64)

Notes:

- Scores corrected for chance (Guilford, 1954). Maximum possible correct = 16.
- The scores for ‘-esa’ / ‘-eza’ words range from –16 to 14 in Sessions A and B and from –10 to 16 in Session C.
- The scores for ‘-esa’ / ‘-eza’ pseudo-words range from –16 to 8 in Sessions A and B and from –10 to 12 in Session C.

The table shows that children improved discrimination of ‘-eza’ / ‘-eza’ words when grades are compared across sessions. The younger children had negative scores in Sessions A and B but reached a positive discrimination score in Session C. Children in the

intermediary grades showed a positive discrimination already in Session A and continued to improve especially in Session C. Finally, the older children showed a stronger positive discrimination already in Session A, which improved in all sessions.

The pattern for the mean scores in ‘-esa’ / ‘-eza’ pseudo-words is different. All the mean scores are negative, and with the exception of Grade 1 in Session A, they cluster close to 0 in all sessions. This indicates that children’s discrimination is random. Children’s lowest mean score in Grade 1 (Session A) is due to the lower scores of both pre-phonetic and one-pattern-only spellers. As it was shown in the categorical analysis (please see Table 6.5) there were 22 children in Session A who were pre-phonetic spellers. There were also 105 children in Session A who used only one pattern for the two suffixes, and that number showed just a slight decrease in Session C.

6.5.2.5 – Analyses of significance of mean differences

In order to examine the second hypothesis, that *there is a progression in the ability to use discrimination in the spelling of ‘-esa’ / ‘-eza’ homophone suffixes*, a mixed ANOVA was conducted. Discrimination of ‘-esa’ / ‘-eza’ words and Pseudo-words were entered in turn as a repeated-measures within subjects factor (Sessions A, B and C) and Grade was entered as a between-subjects factor.

The first analysis dealt with Discrimination of ‘-esa’/ ‘-eza’ Words.

This analysis revealed that there was a significant effect of Session ($F(1, 181) = 75.02, p < .001$) and a significant effect of Grade ($F(2, 181) = 51.10, p < .001$). Pairwise comparisons (Least Significant Difference- LSD, $p < .05$) showed that the scores increased significantly from Session A to Session B, and in turn, to Session C. Post-hoc SNK tests ($p < .05$) showed that in each Session children in the lower grade got significantly lower means than

children in the middle grade, which in turn, performed at a significantly lower level than those of children in the higher grade.

The same analysis was performed for discrimination of ‘-esa’ / ‘-eza’ pseudo-words. It showed that there was a significant effect of Session ($F(1,181) = 13.91, p < .001$) and a significant effect of Grade ($F(2,181) = 3.38, p < .05$). Pairwise comparisons (LSD, $p < .05$) revealed that the mean discrimination scores in Session A were significantly lower than those in Sessions B and C, but the latter two sessions did not differ. SNK tests ($p < .05$) revealed that in Session A the only differences were that children in Grade 1 had significantly lower scores than children in the other grades. Grades 2 and 3 did not differ in Session A. No significant Grade differences were found in Sessions B and C.

It can be concluded that children improved significantly their discrimination of ‘-esa’ / ‘-eza’ words throughout the study but did not do so in pseudo-words. This supports the hypothesis that there is a developmental progression in the ability to use discrimination in the spelling of words ending in the ‘-esa’ / ‘-eza’ homophone suffixes. Although children showed some significant progress in the spelling of pseudo-words, the negative discrimination scores suggest that such results should be taken with caution. Because the spelling of pseudo-words separates out the effects of lexical knowledge, good discrimination would be an indication that knowledge based on morphology was being used to disambiguate the spelling of the suffixes. There is no support for the use of morphological knowledge in the spelling of pseudo-words.

6.5.2.6 – Analysis of predictive relations

It had been hypothesised (Hypothesis 3) that *there is a predictive relation between morphological awareness and discrimination of homophone suffixes ‘-esa’- ‘-eza’, which cannot be explained by individual differences in level of instruction or general intelligence.*

Fixed order hierarchical multiple regressions were conducted in order to examine the role of morphological awareness in predicting discrimination in the spelling of words and pseudo-words ending in the homophone suffixes ‘-esa’ / ‘-eza’.

The relation between morphological awareness in Session A and discrimination in the spelling of suffixes in Session B was examined first. This was followed by the exam of the relation between morphological awareness in Session B and discrimination in Session C. Finally, the relation between morphological awareness in Session A and discrimination in Session C was investigated.

In all regressions Grade and IQ were entered as the first two steps to rule out that any predictions between morphological awareness and the spelling of suffixes could be mainly explained by shared variance with level of instruction (Grade) or general intelligence (IQ). In the third step one of the morphological awareness measures was entered.

The first set of multiple regressions examined whether Word Analogy and Sentence Analogy measured at the beginning of the study (Session A), predicted discrimination in the spelling of words and pseudo-words ending in the homophone suffixes ‘-esa’ / ‘-eza’ in Session B.

Table 6.9 displays the results of the multiple regressions.

Table 6.9: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-esa’ / ‘-eza’ words, in Session B

Outcome measure: Discrimination of ‘-esa’ / ‘-eza’ words in Session B					
Predictors:					
Order entered	r ² change	B	SE B	β	Sig.
In Session A:					F Change
1 – Grade	.293	3.20	.368	.541	.000***
2 – IQ	.063	.141	.034	.253	.000***
3.1 – WA	.000	.048	.173	.024	.781
3.2 – SA	.001	.083	.132	.049	.534

* p<.05; ** p<.01; *** p<.001

The results of the regressions show that neither SA nor WA in Session A predicted accuracy in the spelling of ‘-esa’ / ‘-eza’ words in Session B. Most variance in these analyses is explained by grade differences, followed by IQ.

The next set of regressions (Table 6.10) examined whether the morphological awareness measures taken in Session A predict discrimination of pseudo-words ending in the homophone suffixes ‘-esa’ / ‘-eza’ in Session B.

Table 6.10: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-esa’ / ‘-eza’ Pseudo-words in Session B

Outcome measure: Discrimination of ‘-esa’ / ‘-eza’ Pseudo-words in Session B					
Predictors:					
Order entered in Session A:	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.000	-.008	.031	-.021	.774
2 – IQ	.033	.080	.032	.183	.014*
3.1 – WA	.000	-.005	.166	-.003	.975
3.2 – SA	.000	.012	.127	-.009	.927

* p<.05; ** p<.01; *** p<.001

In these regressions, Grade did not provide significant variance to the equation, which suggests that children spelled these pseudo-words by criteria that, is not dependent on level of instruction. Only IQ accounts for a small proportion of unique variance in these analyses (3 %). Neither Word Analogy nor Sentence Analogy measured in Session A predicted discrimination of ‘-esa’ / ‘-eza’ pseudo-words 6 months later. Thus, the spelling of pseudo-words does not appear to be predictable from levels of instruction, or morphological awareness.

The next set of multiple regressions (Table 6.11) examines whether the scores in the three morphological awareness measures assessed in Session B predict discrimination in the spelling of words ending in the homophone suffixes ‘-esa’ / ‘-eza’ in Session C.

Table 6.11: Summary of Three Fixed Order Hierarchical Multiple Regressions for Word Analogy, Sentence Analogy and Pseudo-word Interpretation, all in Session B, Predicting Discrimination of ‘-esa’ / ‘-eza’ Words in Session C

Outcome measure: Discrimination of ‘-esa’ / ‘-eza’ Words in Session C					
Predictors:					
Order entered in Session B:	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.230	2.80	.379	.480	.000***
2 – IQ	.014	.066	.036	.120	.067
3.1 – WA	.003	.142	.166	.074	.392
3.2 – SA	.018	.307	.145	.191	.035*
3.3 – PWI	.049	.367	.104	.316	.001*

* p<.05; ** p<.01; *** p<.001

The results show that Grade is the major source of significant variance. Conversely, IQ adds 1 % of variance and that approaches significance. Sentence Analogy and the Pseudo-word Interpretation tasks account for unique variance over and beyond shared variance explained by Grade and IQ. The Pseudo-word Interpretation Task on its own accounts for almost 5 % more of unique variance. Word Analogy was not significant. Thus, Sentence Analogy and the Pseudo-word Interpretation in Session B significantly predict the level of discrimination of ‘-esa’ / ‘-eza’ words, 6 months later.

In the next set of regressions (Table 6.12) the predictions from morphological awareness measures in Session B to the spelling of ‘-esa’ / ‘-eza’ pseudo-words in Session C are analysed.

Table 6.12: Summary of Three Fixed Order Hierarchical Multiple Regressions for Word Analogy, Sentence Analogy and Pseudo-word Interpretation, all in Session B, Predicting Discrimination of ‘-esa’ / ‘-eza’ Pseudo-words in Session C

Outcome measure: Discrimination of ‘-esa’ / ‘-eza’ Pseudo-words in Session C					
Predictors:					
Order entered	r ² change	B	SE B	β	Sig.
In Session B:					F Change
1 – Grade	.001	.138	.292	.035	.638
2 – IQ	.005	.027	.028	.072	.333
3.1 – WA	.001	-.057	.129	-.043	.660
3.2 – SA	.002	-.075	.114	-.069	.509
3.3 - PWI	.021	.164	.082	.208	.049*

* p<.05; ** p<.01; *** p<.001

There was no evidence that neither Grade, IQ, WA and SA accounted for significant variance in the spelling of pseudo-words ending in ‘-esa’ / ‘-eza’. The only significant contribution that was found was the Pseudo-word Interpretation Task, contributing with 2 % of unique variance. This may be related to the fact that the cognitive operations required by the PWI, interpreting the changes of meaning that a pseudo-word undergoes when an affix is added, are similar in nature to the decisions required to discriminate whether to spell ‘-esa’ or ‘-eza’. This is because each of the suffixes carry marked differences in meaning and grammatical function for the base morphemes they are added to.

Finally, it was examined whether there were any predictions from the morphological awareness measures in Session A to the level of discrimination found 12 months later, in Session C. The results are displayed in Table 6.13 for words and 6.14 for pseudo-words.

Table 6.13: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy, all in Session A, Predicting Discrimination of ‘-esa’ / ‘-eza’ Words in Session C

Outcome measure: Discrimination of ‘-esa’ / ‘-eza’ Words in Session C					
Predictors:					
Order entered in Session A:	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.230	2.80	.379	.480	.000***
2 – IQ	.014	.066	.036	.120	.067
3.1 – WA	.008	-.262	.184	-.130	.156
3.2 – SA	.001	.083	.142	.050	.560

* p<.05; ** p<.01; *** p<.001

The results show that most of the variance over a period of 12 months is explained by Grade differences, and to a lesser extent IQ differences, but no unique contribution was found from the two morphological awareness measures in discrimination of words ending in ‘-esa’ / ‘-eza’.

In the last set of regressions, the same analyses were performed for ‘-esa’ / ‘-eza’ pseudo-words.

Table 6.14: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy, all in Session A, Predicting Discrimination of ‘-esa’ / ‘-eza’ Pseudo-words in Session C

Outcome measure: Discrimination of ‘-esa’ / ‘-eza’ Pseudo-words in Session C					
Predictors:					
Order entered in Session A:	r ² change	B	SE B	β	Sig. F Change
1 – Grade	.001	.138	.292	.035	.638
2 – IQ	.005	.027	.028	.072	.333
3.1 – WA	.003	-.113	.143	-.083	.429
3.2 – SA	.005	-.104	.110	-.093	.344

* p<.05; ** p<.01; *** p<.001

No evidence of any predictive link between the spelling of ‘-esa’ / ‘-eza’ pseudo-words and Grade, IQ or morphological awareness was found between Sessions A and C.

It had been hypothesised that morphological awareness measured earlier in the study predicted discrimination of words and pseudo-words ending in the homophone suffixes ‘-esa’ / ‘-eza’. No evidence was found over periods of twelve months, i.e., morphological awareness measured in Session A did not predict discrimination in Session C, neither for words nor pseudo-words.

Evidence over periods of six months was mixed. No evidence was found from Sessions A and B but significant predictive contributions were found from Sessions B to C especially in the spelling of words. All morphological awareness measures in Session B contributed unique variance to the outcome variable, 6 months later.

6.5.3 – Summary of results

1 – According to the first hypothesis children were expected to follow a three-phase model (Bryant, 2002) in discrimination of words and pseudo-words ending in ‘-esa’/ ‘-eza’ homophone suffixes.

The categorical analyses provided partial evidence for the above model. Similarly to what was proposed by Bryant (2002), children in the initial grades also tended to use one spelling only for the two suffixes. As schooling progressed, they also tended to use two spelling patterns unsystematically. However, only approximately 5 % of the children reached a systematic assignment of the suffixes and only when spelling words. Thus, evidence is stronger for the first two phases of the model, but weaker for the last phase.

Despite that, the trend of development was positive. The phase model that was identified correlated positively and significantly with age. Comparisons of spelling phases, at the beginning and at the end of the study, revealed that most children either stayed in the same phase or progressed towards a more advanced phase.

2 – According to the second hypothesis, significant progression was expected in the ability to discriminate the homophone suffixes. The evidence supported this hypothesis. Significant effects of Session and Grade on Discrimination of ‘-esa’/ ‘-eza’ Words and Discrimination of ‘-esa’/ ‘-eza’ Pseudo-words were found. Children showed a positive discrimination of ‘-esa’/ ‘-eza’ words as the study progressed and grade increased, but although progress was also significant, it never reached a positive discrimination of pseudo-words.

3 – According to the third hypothesis, a specific and predictive relation was expected between morphological awareness and discrimination of suffixes. The study provided evidence for a predictive relation between morphological awareness in Session B (as measured by the Sentence Analogy and the Pseudo-word Interpretation Task) and Discrimination of ‘-esa’/ ‘-eza’ Words in Session C. Evidence was also found that performance in the Pseudo-word Interpretation Task in Session B predicted discrimination of pseudo-words in Session C.

No evidence of predictive relations was found from measures of morphological awareness in Session A and discrimination in sessions B or C.

6.6 –DISCUSSION AND CONCLUSIONS

This study provided evidence that discrimination of the homophone suffixes ‘-esa’ / ‘-eza’ could be described as a sequence of spelling phases. The classification system that was used clearly assigned each child to a spelling phase. Spelling phases were found to correlate significantly with age. The majority of children were found to stay in the same phase or progress to higher phases.

It was also found that, after a period of pre-phonetic spellings justified by the need to master basic sound-letter correspondences many children used only one spelling pattern for both suffixes. They dropped this approach progressively as schooling improved, and a more sophisticated approach was experimented – the use of more than one spelling pattern. This suggests that children noticed that exceptions could not be accommodated by the use of a single pattern. However, this new strategy does not imply that children know how to make the necessary morphological connections, and this is why the spelling patterns are

not assigned systematically. In this study, it was found that the last spelling phase, systematic assignment, was rare, even for 9-year-olds (at the end of Grade 4).

With the exception of the last phase, these findings are consistent with the spelling model proposed in the literature (Nunes et al., 1997 a, b; Bryant, 2002; Aidinis, 1998).

In this study, 12 to 13.6 % of children were found to regress to a less advanced phase. This backward move occurs mainly with children that were already using two-patterns unsystematically, and that regressed to the use of one-pattern systematically. This may be related to the impossibility of finding a rule when using more than one spelling pattern. If one-pattern is systematically used for the two suffixes, children will be 100 % right in one of the suffixes and 100 % wrong in the corresponding homophone. Children may feel that this is more effective than using two-patterns unsystematically, especially if they are making small progress in using the two patterns mostly on right positions. Within this probabilistic approach, children may turn to the use of the spelling pattern that they felt as the most effective in previous attempts. However, understanding why some children regressed requires additional research.

Evidence was also provided that progress in the use of spelling patterns and on quantitative discrimination of the suffixes was made accordingly to what was developmentally expected.

Morphological awareness was found to progress with grade and to predict discrimination in the spelling of suffixes over a period of 6 months. The Sentence Analogy and the Pseudo-word Interpretation in Session B were found related to the level of discrimination in the spelling of words 6 months later. Most importantly, this prediction is specific because it could not be explained by the shared contribution of factors such as Grade or IQ.

A longer longitudinal study is needed including older children that examines when a systematic assignment of these homophone morphemes is possible and controls even better for the influence of third factors. Such a study can be complemented with case studies searching why some children do not progress in the right direction. Finally, intervention studies that make explicit the morphological rules governing discrimination of homophone morphemes are needed, in order to evaluate whether children can learn these rules, and whether this learning can be maintained in the longer term.

Chapter 7

Study 5 - Morphological Awareness and

Discrimination of ‘-ice’ / ‘-isse’ Homophone Suffixes: Longitudinal Study

7.1 - RATIONALE

The aim of this study is to describe the acquisition of the discrimination of homophone suffixes ‘-ice’ / ‘-isse’ and consider whether morphological awareness predicts this discrimination.

The above suffixes are pronounced in the same way but their spelling differs according to the grammatical function of the word. The suffix ‘-ice’ is a derivational suffix that forms abstract nouns (e.g., ‘maluquice’, foolishness), and ‘-isse’ is an inflectional suffix that forms the first and third persons singular of the subjunctive of some verbs (e.g., ‘se eu fugisse’, if I ran away).

Evidence for a marginal concurrent relation between morphological awareness (measured by the Sentence Analogy Task) and the spelling of words ending in the above suffixes was reported in Chapter 4, when the results for Session A were analysed. No evidence was found in that Session for a relation between morphological awareness and the discrimination in the spelling of pseudo-words.

In this chapter, longitudinal predictions are analysed.

Similarly to the previous chapter two types of quantitative analyses will be performed. The first, a categorical analysis, examines children’s phases of spelling (Nunes et al., 1997 a; Bryant, 2002). In the second, an analysis of spelling discrimination, the scores are examined as a continuous variable.

Three hypotheses are tested. The first relates to the analysis of phases of spelling and the remaining to discrimination as a continuous variable.

Hypotheses:

1 – Correct assignment in the spelling the homophone suffixes ‘-ice’ / ‘-isse’ will follow a series of spelling phases: younger children will tend to use one pattern only for the two suffixes; this is followed by the use of alternative patterns without systematic assignment, and by a phase in which systematic assignment is achieved.

2 – There is an increase with grade in the ability to use discrimination in the spelling of ‘-ice’ / ‘-isse’ homophone suffixes.

3 - There is a predictive relation between morphological awareness and discrimination of homophone suffixes ‘-ice’ / ‘-isse’, which cannot be explained by individual differences in level of instruction or general intelligence.

7.2 – PARTICIPANTS

The participants were the same 184 children as referred in the previous chapter.

They came from two state-supported primary schools in the greater Lisbon area, in Portugal.

Children were in Grades 1 to 4 (6- to 9-year-olds) and were randomly assigned from the school register, as detailed in chapter 4.

7.3 – DESIGN

Children were assessed three times (Sessions A, B and C) on their awareness of morphology, and on discrimination in the spelling of ‘-ice’ / ‘-isse’ suffixes. Session B took place 6 months after Session A. Session C took place 12 months later than Session A.

Awareness of morphology was assessed with three measures. The Word Analogy and Sentence Analogy tasks were repeated in the three sessions and the Pseudo-word Interpretation Task was introduced in sessions B and C.

Discrimination in the spelling of ‘-ice’ / ‘-isse’ homophone suffixes was assessed with a spelling task in the three sessions. It contained words and pseudo-words. Pseudo-words were intended to provide control for lexical knowledge.

In this design the outcome measures are Discrimination in the Spelling of Words (or Pseudo-words) ending in the homophone suffixes ‘-ice’ / ‘-isse’, and the predictors are the three morphological awareness measures, Word Analogy, Sentence Analogy and the Pseudo-word Interpretation Task. Grade and IQ were entered as covariates or control factors.

7.4 – MATERIALS and PROCEDURE

7.4.1 – The morphological awareness measures

For a description of the three morphological awareness measures and the procedures used, please refer to the previous chapters four and five.

7.4.2 – The spelling task

The spelling task was performed in Sessions A, B and C. There were 32 items assessing discrimination in the spelling of ‘-ice’ / ‘-isse’ homophone suffixes. There were 8 words and 8 pseudo-words assessing the spelling of the suffix ‘-ice’ and 8 words and 8 pseudo-words for the suffix ‘-isse’. These items were interspersed in a list of 96 stimuli (Appendix 4.1). This list was divided in two sub-lists of 48 stimuli that were presented on two consecutive days. Each list was presented in the same order to all children and contained words and pseudo-words. The stimuli were orally presented by the experimenter in a sentence context.

The procedure was the same as reported in the previous chapter.

7.4.3 – The standardised measure

In Session A, each child was seen individually in a quiet room and presented with a shortened version of WISC standardised for the Portuguese population by Marques (1970). This consisted of four sub-tests of each Verbal (Vocabulary, Digit Span, Similarities and Arithmetic) and Performance (Picture Completion, Picture Arrangement, Block Design and Object Assembly) IQ sub-scales.

The procedure was as detailed in the WISC Manual (Marques, 1970).

7.5 – RESULTS

7.5.1 – Analyses of scores as categories: the spelling model

7.5.1.1 - Scoring

The spellings in each suffix were classified according to three categories:

1 - Morphologically correct - those in which the suffix was spelled according to grammar, e.g., [ice] for ‘-ice’, [isse] for ‘-isse’.

2 - Phonologically acceptable but incorrect - those that did not represent a correct grammar representation or not respected hierarchical rules but had acceptable phonological representations for the sounds in the suffix. For example, the suffix ‘-ice’ spelled as [-isse], [içe], [-ise] or [-i-se] and the suffix ‘-isse’ spelled as [-ice], [-içe], [-ise] or [-i-se].

3 - Non-phonological spellings - those spellings that did not adequately represent the sounds of the suffixes. For example, the suffix ‘-ice’ spelled as [-ize] or [-ica] and the suffix ‘-isse’ spelled as [-isa] or [-ixe].

In order to devise the spelling model a new variable was computed. This variable defines a cut-off point separating pre-phonetic spellers from those that use phonologically acceptable and/or morphologically correct spellings. This variable was called Sensible Spellings and sums up the morphologically correct plus phonologically acceptable but incorrect spellings.

7.5.1.2 – Criteria to devise phases of spelling

Strict achievement criteria were defined to devise the phases in the spelling model, following those used in Nunes et al. (1997 a) longitudinal study. Four phases were generated and were tested longitudinally.

Phase 1: Pre-phonetic - To be classified in this phase *less than 9 out of 16* spellings are sensible representations for the suffixes. Sensible spellings are all those that are either morphologically correct or phonologically acceptable but incorrect. For example, the child uses mostly non-sensical spellings such as [-ica] or [-isa] to spell the suffixes ‘-ice’ or ‘-isse’.

Phase 2: One Pattern Only - For a child to be classified in this phase it is necessary to show that the previous one was overcome. Thus, *more than 8 out of 16* spellings are sensible, and the child uses one form of spelling for both homophone suffixes up to 14 out of 16 times. This means that an alternative spelling cannot occur more than twice. For example, the child spells the morphemes ‘-ice’ and ‘-isse’ as [ice] at least 14 out of 16 times.

Phase 3: Two Patterns Unsystematic - *More than 8 out of 16* spellings are sensible and the child uses two patterns of spelling. Each of these two patterns must be observed at least 3 times for the child to be considered a two-pattern user. Each spelling pattern can be correctly assigned or not to the corresponding suffix. When the assignment is correct, it should stay below the level that is considered systematic (7 out of 8 correct in each suffix, as in the next phase). When the assignment is not correct, any number higher than 2 is accepted. For example the child uses any number of spellings above 2 of [isse] and [ice] for the suffixes ‘-ice’ and ‘-isse’ (non-correct assignment), or any number higher than 2 and lower than 7 of [ice] and [isse] to spell ‘-ice’ and ‘-isse’, respectively (correct assignment).

Phase 4: Two Patterns Systematic - The child assigns morphologically correct spellings for each of the two homophone suffixes at least 7 out of 8 times. This means that ‘-ice’ is spelled as [ice] at least 7 times and ‘-isse’ is spelled as [isse] at least 7 times.

7.5.1.3 – Frequencies of phases of spelling

It was hypothesised (Hypothesis 1) that *correct assignment in the spelling the homophone suffixes ‘-ice’ / ‘-isse’ will follow a set of spelling phases: younger children will tend to use one pattern only for the two suffixes; this is followed by the use of alternative patterns without systematic assignment; eventually systematic assignment is achieved.*

In order to examine the above hypothesis, analyses of the number of children that entered each spelling phase, correlations assessing the relation between spelling phases and age, and comparisons of spelling classifications of children at the beginning and at the end of the study were performed. These analyses categorise which spelling choices children use, examine whether more complex spelling phases reflect improvement that is expected as age / grade increases, and investigate children’s mobility in the use of different spelling phases across time.

In order to perform the first analysis, frequencies of spelling phases in each session and grades were computed.

Tables 7.1 and 7.2 present the number of children that used a certain spelling phase to spell the homophone suffixes ‘-ice’ / ‘-isse’, in words and pseudo-words, across Sessions and Grades.

Table 7.1: Frequencies of phases of spelling for ‘-ice’ / ‘-isse’ words by Session and Grade

‘-ice’ / ‘-isse’ Words									
	Session A			Session B			Session C		
	Grades			Grades			Grades		
	1	2	3	2	3	4	2	3	4
N =	64	61	59	64	61	59	64	61	59
Phases of Spelling:									
Pre-phonetic	12	2	0	5	1	0	2	1	0
One-pattern only	35	18	7	43	23	7	23	15	10
Two-unsystematic	17	40	51	16	37	49	38	43	47
Two-systematic	0	1	1	0	0	3	1	2	2

Table 7.1 shows that pre-phonetic spellers occur mostly in Grade 1. There are still some pre-phonetic spellers in Grades 2 and 3 but the numbers are very small. Pre-phonetic spellings can be related to the fact that the representation of the sound /s/, the middle sound in the suffixes, is difficult. In the general language, this sound can take different spellings [s], [ss], [c], [ç] according to morphology or hierarchical rules. There are further distinctions that young spellers have to learn as, for example, that 's' between vowels does not represent the sound /s/ but represents the sound /z/, and that 'c' most frequently represents the sound /k/. Some pre-phonetic spellers also showed that the representation of the first vowel of the suffixes was problematic. In fact, the sound /i/ represented by [i] in '-ice' or '-isse' can be represented in the general language by [i] or [e] depending on context or morphology. This is probably why some children spelled the initial vowel as [e] as in [ece], [ese], [esse] or [e-se]. Other spellings reveal a similar problem to deal with the last vowel in the suffixes in which the opposite marking with [i] is used, as in [içi] or [isi].

The table also shows that one-pattern-only users decrease in frequency as grade increases. Two-pattern-unsystematic users increase in frequency as the previous pattern decreases. This is an indication that younger children tend to use one pattern only and, as they develop in age and instruction, start to notice that an alternative pattern is necessary.

The number of children that reached systematically correct representations of the words ending in '-ice'/'-isse' suffixes was very small.

The same analysis was performed for the spelling of pseudo-words. The results are displayed in Table 7.2.

Table 7.2: Frequencies of patterns of spelling for ‘-ice’ / ‘-isse’ pseudo-words by Session and Grade

‘-ice’ / ‘-isse’ Pseudo-words									
	Session A			Session B			Session C		
	Grades			Grades			Grades		
	1	2	3	2	3	4	2	3	4
N =	64	61	59	64	61	59	64	61	59
Phases of spelling:									
Pre-phonetic	13	1	0	6	2	0	1	0	0
One-pattern only	41	38	22	43	38	20	38	24	25
Two-unsystematic	10	22	37	15	21	39	25	37	34
Two-systematic	0	0	0	0	0	0	0	0	0

Table 7.2 shows that most pre-phonetic spellings appear in the first grade and decrease thereafter. The table also shows that one-pattern-only users decrease as grade increases, and that two-pattern-unsystematic users increase as the previous pattern decreases. No children could assign the suffixes systematically in the spelling of pseudo-words.

It can be concluded that there is a clear progression from pre-phonetic spellings to phonologically acceptable representations for the sounds in the suffixes. Firstly, children use one spelling pattern for the two suffixes. Later on, they attempt to find out alternative patterns but a shift from phonologically acceptable representations to morphologically determined spellings is not systematically achieved.

This analysis provides moderate support that Portuguese children follow the same spelling phases of the developmental model suggested in Nunes et al. (1997 a) and corroborated by the cross-linguistic literature (Aidinis, 1998; Bryant et al. (1999); Bryant, 2002; Fayol et al., 1999;). This support is moderate because evidence for the last phase is lacking.

7.5.1.4 – The test of the spelling model

As proposed by Nunes et al., 1997, a), three tests are needed to examine the model of spelling phases: to analyse whether no children are left unclassified, to show that children’s ages and phases of spelling are positively correlated and to ascertain that most children did not regress in the spelling phases.

No children were left unclassified as a consequence of the logical system of achievement criteria that was used. Correlations were computed between phases of spelling and age in order to examine whether there was a developmental structure of phases of spelling, i.e., younger children were in the earlier phases and older children in the more advanced phases. Table 7.3 displays the correlations that were found.

Table 7.3: Pearson Correlations between Age in Sessions A, B and C and Phases of Spelling of ‘-ice’ / ‘-isse’ words and pseudo-words.

	Phases of Spelling	
	‘-ice’ / ‘-isse’	‘-ice’ / ‘-isse’
	Words	Pseudo-words
Age Session A	.52***	.44***
Age Session B	.54***	.38***
Age Session C	.20**	.20**

Notes: *** p<. 001; ** p<. 01;

Significant positive correlations were found between age and spelling phases. This is evidence that younger children used spelling strategies that were lower in the model and older children used strategies that were higher. The lower, but significant, correlations in Session C are

explained by less variation in spelling phases in this session, as most children clustered around phases 2 (one-pattern-only) and 3 (two-patterns-unsystematic).

Thus, these correlations support a developmentally shaped model of spelling phases.

In order to perform the third test, cross-tabulations of children’s spelling phases in Session A and C were performed. Session B was excluded because of differences in amount of time of instruction due to the occurrence of summer holidays between Sessions A and B, as explained in the previous chapter.

The cross-tabulations allow the comparison of the relative positions of children in the spelling phases at the beginning and end of the study. The results are displayed in Table 7.4 for the spelling of words and Table 7.5 for pseudo-words.

Table 7.4: Crosstabulation of phases of spelling between Sessions A and C, in words ending in the homophone suffixes ‘-ice’ / ‘-isse’

	‘-ice’ / ‘-isse’ Words				Total (A)
	Phases in Session C				
	1	2	3	4	
<hr/>					
Phases in Session A					
1 – Pre-phonetic	1	8	5	0	14
2 – One-pattern-only	1	23	35	1	60
3 – Two-unsystematic	1	17	88	2	108
4 – Two-systematic	0	0	0	2	2
Total (C)	3	48	128	5	184

This table shows that the 14 children that were pre-phonetic spellers in Session A, 8 of them progressed one phase and 5 progressed two phases. Only one child remained in the same phase. There were 60 one-pattern-only users in Session A. More than half of the children (35) progressed to the following spelling phase. There is also a greater number of children that used two-patterns-unsystematic in Session C when compared to Session A, although the majority stayed in this same phase. A few children used the two morphologically correct patterns systematically. Some children regressed to lower phases (19) especially those that used two-patterns-unsystematically in Session A. Comparing the right hand column (total in Session A) with the bottom row (total in Session C) it is clear that, at the end of the study, there are fewer pre-phonetic spellers (14 / 3), fewer one-pattern-only spellers (60 / 48), more two-unsystematic spellers (108 / 128) and more two-systematic spellers (2 / 5). After a 12 months interval, 62 % of the children stayed in the same phase, 27.7 % progressed to higher phases and 10.3 % regressed to lower phases.

Thus, overall progress is in the right direction. The table suggests that mobility in the spelling phases is apparent for pre-phonetic spellers and one-pattern-only users. However, mobility towards systematic assignment of the suffixes becomes rather difficult. Children are aware that more than one spelling pattern is necessary but do not know the morphological rule that is required to decide which spelling to use. This is why most children that were two-unsystematic users in Session A remained in the same phase a year later.

In the next Table, the cross-tabulations for the spelling of pseudo-words are displayed.

Table 7.5: Crosstabulation of phases of spelling between Sessions A and C, in pseudo-words ending in the homophone suffixes ‘-ice’ / ‘-isse’

	‘-ice’ / ‘-isse’ Pseudo-words				Total (A)
	Phases in Session C				
	1	2	3	4	
<hr/>					
Phases in Session A					
1 – Pre-phonetic	1	11	2	0	14
2 – One-systematic	0	54	47	0	101
3 – Two-unsystematic	0	22	47	0	69
4 – Two-systematic	0	0	0	0	0
Total (C)	1	87	96	0	184

This table shows that only 1 out of 14 children that were pre-phonetic spellers in Session A remain in that phase a year later. Most pre-phonetic spellers progressed one phase and 2 children progressed two phases. Again, the comparison between the totals in Session A and in Session C reveal that fewer children were one-pattern-only users (101 / 87) and more children were two-patterns-unsystematic users (69 / 96). The pattern of mobility is similar to what was found in the spelling of words, except that no children achieved systematic assignment for the spelling of the suffixes in pseudo-words. From the 69 children that already used two-patterns-unsystematically in Session A, approximately two-thirds remained in the same phase and one-third regressed to the use of a simpler strategy, spelling the two homophone suffixes in the same way. After a 12 months interval, 55.4 % of the children stayed in the same spelling phase, 32.6 % progressed to more advanced phases and 12 % regressed to a less advanced phase.

This indicates that the overall move is in the right direction too, when spelling pseudo-words. These results also suggest that children progress quickly from pre-phonetic spellings to the use of more than one patterns that are phonologically acceptable but take a considerable time (one year is not enough) to make the next move, from spellings that are phonologically based to spellings that are morphologically based. In the case of words, systematic assignment can be based both on lexical information and some knowledge of morphology. In the case of pseudo-words, no lexical information can be taken in. Therefore, only knowledge of how the suffixes transform the base forms allows for systematic assignment.

To summarise, it had been hypothesised that Portuguese children would follow a model of spelling phases in which they would tend first to use one-pattern-only for the two homophone suffixes, then would introduce an alternative pattern to accommodate exceptions and eventually would reach systematic assignment. It was found that consideration for a pre-phonetic phase was needed for those children that could not yet select phonologically acceptable spellings most of the time. Confirmation for the trend that one-pattern-only was used before two-patterns-unsystematic was obtained (Aidinis, 1998; Nunes, et al., 1997; Fayol et al., 1999). No relevant confirmation for the last phase could be reached.

7.5.2 – Analyses of scores as continuous variables: spelling discrimination

7.5.2.1 – Scoring

The spellings were scored as correct (1), or incorrect (0). Correct scores were those in which the only one acceptable morphological spelling for each morpheme ‘-ice’ and ‘-isse’ was fully respected. All other representations, even if phonologically acceptable, were scored as incorrect.

After calculating the number correct and incorrect, each child’s score was transformed into a discrimination score corrected for chance (Guilford, 1954). These scores can vary, in theory, from –16 (not one stimulus accurately discriminated) to 16 (all stimuli accurately discriminated). Although, in theory, the scores can vary between -16 and 16, in practice this is not expected. Negative scores indicate a systematic error where the child tends to write most ‘-ice’ as [isse] and most ‘-isse’ as [ice]. A value of zero (0) is obtained when the number correct equals the number incorrect. This indicates lack of knowledge or random choice and is frequently the case when the child uses just one pattern to spell the two homophone suffixes. The details of how the scores were computed were explained in the fourth chapter.

7.5.2.2 – Analyses of reliability and skewness

The results for the reliability found in Session A were already reported in Chapter 4. Those indicated an Alpha of .92 for Discrimination in the Spelling of Words ending in the Homophone Suffixes ‘-ice’/ ‘-isse’ and of .85 for Discrimination in the Spelling of Pseudo-words. Table 7.6 displays, now, the results for items’ reliability in Sessions B and C.

Table 7.6: Items’ Reliability (Alpha, $p < .05$) for Discrimination in the Spelling of Words and Pseudo-words ending in the Homophone Suffixes ‘-ice’/ ‘-isse’, in Sessions B and C.

Measures	Number Of Items	Session B	Session C
Discrimination of homophone suffixes:			
- ‘-ice’/ ‘-isse’ Words	16	.84	.80
- ‘-ice’/ ‘-isse’ Pseudo-words	16	.82	.74

The above table shows that reliabilities are high and stable and always above .70, indicating that variation in each session in how children answered each item was done under a pattern that was consistent.

As for the analysis of skewness in Session A, a $z = 2.22$ had been found for discrimination of ‘-ice’/ ‘-isse’ Words, after normalisation by the Rank Normal Blom method, and $z = 0.42$ had been found for discrimination in the spelling of Pseudo-words. Table 7.7 displays the results for skewness in Sessions B and C.

Table 7.7: Skewness (z) for Discrimination in the Spelling of Words and Pseudo-words ending in the Homophone Suffixes ‘-ice’/ ‘-isse’, in Sessions B and C.

	Session B	Session C
Discrimination of homophone suffixes:		
- ‘-ice’/ ‘-isse’ Words	2.29(a)	1.55
- ‘-ice’/ ‘-isse’ Pseudo-words	0.15	- 1.85

Note: (a) $z = - 0.21$, after normalisation by the Rank Normalise Blom method.

The table shows that the outcome measures are not significantly skewed except for ‘-ice’/ ‘-isse’ words in Session B, which presents a very moderate positive skewness. The latter variable was successfully normalised by the Rank Normalise Blom (1958) method.

7.5.2.3 – Analyses by Normal Probability Plots

A Normal probability Plot was conducted in order to examine whether the observed scores in Discrimination of ‘-ice’/ ‘-isse’ Words in Session B deviated sharply from what should be expected in a normal distribution. This is presented in Figure 7.1.

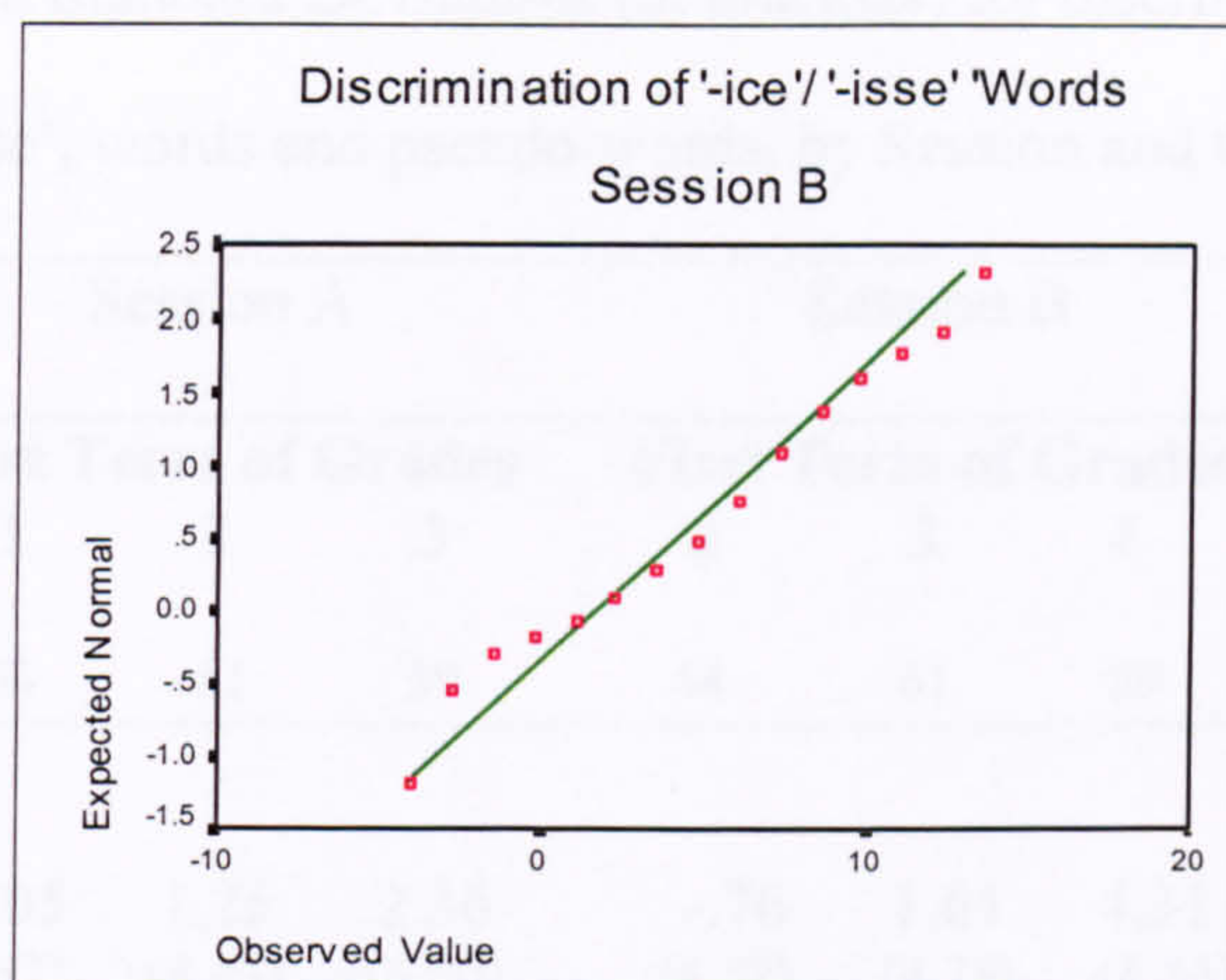


Figure 7.1: Normal Probability Plot for Discrimination in the Spelling of Words ending in the Homophone Suffixes ‘-ice’/ ‘-isse’, in Session B.

The plot shows that there is no sharp deviation between the observed and expected scores, and therefore, normality of distribution can be assumed.

7.5.2.4 – Analyses of means and standard deviations

The next analysis examines whether children improved their spelling across sessions and whether the mean differences were significant.

Table 7.8 displays the means and standard deviations for discrimination of the homophone suffixes ‘-ice’ / ‘-isse’ that were found.

Table 7.8: Means and Standard Deviations (in brackets) for discrimination in homophone suffixes ‘-ice’ – ‘-isse’, words and pseudo-words, by Session and Grade.

	Session A			Session B			Session C		
	Last Term of Grades			First Term of Grades			Last Term of Grades		
	1	2	3	2	3	4	2	3	4
N =	64	61	59	64	61	59	64	61	59
ICE/ISSE Words	-1.05 (3.87)	1.25 (4.44)	2.36 (4.20)	-.76 (4.22)	1.61 (4.78)	4.31 (4.24)	1.96 (4.71)	3.01 (4.81)	4.05 (4.51)
ICE/ISSE Pseudo-words	-1.09 (4.16)	1.90 (4.64)	2.57 (3.99)	-1.03 (3.93)	1.90 (4.59)	3.29 (3.78)	1.64 (4.53)	2.25 (3.98)	2.87 (4.22)

Notes:

- Scores corrected for chance (Guilford, 1954). Maximum possible correct = 16.
- The scores for ‘-ice’ / ‘-isse’ words range from -4 to 14.75 in Session A, from -4 to 13.50 in Session B and from -4 to 16 in Session C.
- The scores for ‘-ice’ / ‘-isse’ pseudo-words range from -4 to 9.75 in Session A, from -4 to 11 in Session B and from -4 to 13.50 in Session C.

The table shows that children at the end of grade 1 in Session A, and beginning of grade 2 in Session B, discriminate the suffixes negatively, and only reach positive ground in the last term of grade 2 in Session C. This pattern is observed both in the spelling of words and pseudo-words. Children in the middle grades show a positive discrimination in all sessions and progress across sessions when spelling words. Positive discrimination is also found in the spelling of pseudo-words but progress is only apparent from Sessions B to C. Children in the higher grades show a higher level of discrimination in both words and pseudo-words, with more apparent progress between Sessions A and B than between Sessions B and C.

7.5.2.5 – Analyses of significance of mean differences

It was hypothesised (hypothesis 2) that *there is an increase with grade, in the ability to use discrimination in the spelling of ‘-ice’ / ‘-isse’ homophone suffixes.*

In order to examine the significance of the mean differences, a mixed ANOVA was conducted with discrimination of ‘-ice’ – ‘-isse’ words in Sessions A, B and C as a repeated-measures within subjects factor, and Grade as a between-subjects factor. This analysis examines the effects of grade across sessions (the interval between two sessions represents six months of schooling) and the effects of grade in each session (where children in ascending grades have one more year of schooling).

This analysis revealed that there was a significant effect of Session ($F(1, 181) = 42.26, p < .001$) and a significant effect of Grade ($F(2, 181) = 13.93, p < .001$). Pairwise comparisons (Least Significant Difference- LSD, $p < .05$) were performed in order to understand further the effect of Session. These showed that the scores increased significantly from Session A to Session B and from Session B to Session C. Post-hoc SNK tests ($p < .05$) were also performed in order to scrutinise significant effects of Grade in each Session. As for Session A, the post-hoc tests revealed that children who started the study at the end of grade 1 got significantly lower scores than children who started at the end of grade 2, which, in turn, were significantly lower than those who started at the end of grade 3. This same pattern of results was found in Sessions B and C.

A second mixed ANOVA was conducted with discrimination of ‘-ice’ – ‘-isse’ pseudo-words. Significant effects of Session ($F(1, 181) = 34.35, p < .001$) and Grade ($F(2, 181) = 18.32, p < .001$) were also found. Pairwise comparisons (LSD, $p < .05$) revealed that discrimination scores in Session A did not differ from the scores in Session B. There were significant

differences when discrimination from Sessions B to C and from A to C were compared. Post-hoc SNK tests ($p < .05$) revealed that discrimination increased significantly with Grade. In each Session, children in the higher grades were significantly more discriminative than children in the middle grades. Similarly the latter group was significantly more accurate than children in the initial grades.

It can be concluded that children improved significantly their discrimination of '-ice' / '-isse' words and pseudo-words throughout the study. This supports the hypothesis that there is a progression with grade in the ability to discriminate the spelling of words and pseudo-words with the homophone suffixes '-ice' / '-isse'. This effect was obtained across Sessions (with the exception of '-ice' / '-isse' pseudo-words from Sessions A to B) and in each Session.

7.5.2.6 – Analysis of predictive relations

It was hypothesised (hypothesis 3) that *there is a predictive relation between morphological awareness and discrimination of homophone suffixes '-ice' - '-isse', which cannot be explained by individual differences in level of instruction or general intelligence.*

In order to examine whether morphological awareness predicts discrimination in the spelling of words and pseudo-words fixed order hierarchical multiple regressions were conducted. The relation between morphological awareness in Session A and discrimination in the spelling of suffixes in Session B was examined first. Then, the relation between morphological awareness in Session B and discrimination in Session C. Finally, the relation between morphological awareness in Session A and discrimination in Session C was investigated.

In all regressions, Grade and IQ were entered as the first two steps to rule out that any relations between morphological awareness and discrimination in the spelling of suffixes could be explained by shared variance with level of instruction (Grade), or with general intelligence (IQ).

In each regression, one of the morphological awareness measures was entered as the third step.

The first set of multiple regressions examined whether Word Analogy and Sentence Analogy measured at the beginning of the study (Session A) predicted discrimination in the spelling of words and pseudo-words ending in the homophone suffixes ‘-ice’ – ‘-isse’ in Session B.

Table 7.9 displays the results of the two fixed order hierarchical multiple regressions.

Table 7.9: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-ice’ / ‘-isse’ words in Session B

Outcome measure: Discrimination of ‘-ice’ / ‘-isse’ words in Session B					
Predictors:					
Order entered	r ² change	B	SE B	β	Sig.
In Session A:					F Change
1 – Grade	.183	2.54	.398	.428	.000***
2 – IQ	.095	.175	.036	.311	.000***
3.1 – WA	.001	.080	.184	.039	.663
3.2 – SA	.014	.266	.140	.158	.059

* p<. 05; ** p<. 01; *** p<. 001

The results of these two regressions show that Grade and IQ account for most of the unique variance in the regression equation. However, Sentence Analogy in Session A (but not Word

Analogy) marginally predicts discrimination in the spelling of ‘-ice’ / ‘-isse’ words in Session B (p = .059) after controlling for Grade and IQ.

The next set of regressions examined whether the morphological awareness measured in Session A predict discrimination of pseudo-words with the homophone suffixes ‘-ice’ / ‘-isse’ in Session B.

Table 7.10: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-ice’ / ‘-isse’ Pseudo-words in Session B

Outcome measure: Discrimination of ‘-ice’ / ‘-isse’ Pseudo-words in Session B					
Predictors in Session A	r ² change	B	SE B	β	Sig. F Change
Order entered:					
1 – Grade	.175	2.29	.369	.419	.000***
2 – IQ	.093	.159	.033	.307	.000***
3.1 – WA	.002	.119	.170	.063	.485
3.2 – SA	.020	.294	.129	.189	.024*
p<. 05; ** p<. 01; *** p<. 001					

In these regressions, Sentence Analogy measured in Session A significantly predicted discrimination of ‘-ice’ / ‘-isse’ pseudo-words, 6 months later. Word Analogy did not contribute with significant variance. Grade and IQ are also significant but Sentence Analogy added 2 % unique variance after controlling for Grade and IQ.

Thus, Sentence Analogy provided a significant unique contribution in discrimination of pseudo-words and almost significantly predicted discrimination in the spelling of words over a period of six months, despite of the relevant contributions of grade and general intelligence.

The next set of multiple regressions (Table 7.11) examines whether the scores in the three morphological awareness measures assessed in Session B predict discrimination in the spelling of words ending in the homophone suffixes ‘-ice’ / ‘-isse’, in Session C. In these regressions, one has now three predictors, the Word Analogy, Sentence Analogy and a new measure, the Pseudo-word Interpretation Task.

Table 7.11: Summary of Three Fixed Order Hierarchical Multiple Regressions for Word Analogy, Sentence Analogy and Pseudo-word Interpretation, all in Session B, Predicting Discrimination of ‘-ice’ / ‘-isse’ Words in Session C

Outcome measure: Discrimination of ‘-ice’ / ‘-isse’ Words in Session C					
Predictors:					
In Session B	r ² change	B	SE B	β	Sig.
Order entered:					F Change
1 – Grade	.033	1.05	.421	.181	.014*
2 – IQ	.102	.175	.038	.321	.000***
3.1 – WA	.014	.304	.174	.159	.083
3.2 – SA	.044	.468	.152	.294	.002*
3.3 – PWI	.050	.366	.111	.318	.001*

* p<. 05; ** p<. 01; *** p<. 001

The results show that Sentence Analogy and the Pseudo-word Interpretation tasks account for unique variance over and beyond the significant contributions explained by Grade and IQ. Word Analogy was non-significant, although it approached significance.

Thus, Sentence Analogy and the Pseudo-word Interpretation in Session B significantly predict how much discrimination of ‘-ice’ / ‘-isse’ words children achieve 6 months later.

The next set of three regressions examines predictions from morphological awareness measures in Session B to the spelling of ‘-ice’ – ‘-isse’ pseudo-words in Session C.

Table 7.12: Summary of Three Fixed Order Hierarchical Multiple Regressions for Word Analogy, Sentence Analogy and Pseudo-word Interpretation, all in Session B, Predicting Discrimination of ‘-ice’ / ‘-isse’ Pseudo-words in Session C

Outcome measure: Discrimination of ‘-ice’ / ‘-isse’ Pseudo-words in Session C					
Predictors:					
In Session B	r ² change	B	SE B	β	Sig.
Order entered:					F Change
1 – Grade	.094	1.58	.363	.307	.000***
2 – IQ	.105	.159	.033	.326	.000***
3.1 – WA	.005	.163	.150	.096	.280
3.2 – SA	.026	.321	.131	.226	.015*
3.3 – PWI	.079	.411	.093	.400	.000***
* p<. 05; ** p<. 01; *** p<. 001					

The Table shows that over and beyond the significant differences explained by Grade and IQ, the Sentence analogy and the Pseudo-word Interpretation tasks in Session B explained unique variance in the level of discrimination of ‘-ice’ / ‘-isse’ pseudo-words. The Pseudo-word Interpretation Task, on its own, accounted for more 8 % of unique variance.

It can be concluded that children’s morphological awareness in Session B, as measured by the Sentence Analogy and the Pseudo-word Interpretation tasks, can be causally related to the ability to discriminate the spelling of both words and pseudo-words, six months later. Finally, it was examined whether there were any predictions from the two morphological awareness measures in Session A to the level of discrimination found 12 months later, in Session C. This is displayed in Table 7.13.

Table 7.13: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-ice’ / ‘-isse’ Words in Session C

Outcome measure: Discrimination of ‘-ice’ / ‘-isse’ Words in Session C					
Predictors in Session A	r ² change	B	SE B	β	Sig.
Order entered:					F Change
1 – Grade	.033	1.05	.421	.181	.014*
2 – IQ	.102	.175	.038	.321	.000***
3.1 – WA	.005	.200	.195	.100	.306
3.2 – SA	.022	.322	.148	.196	.031*
p<. 05; ** p<. 01; *** p<. 001					

The results displayed in Table 7.13 show that Grade and especially IQ differences explain some of the variance over a period of 12 months. However, despite controls for Grade and IQ, the Sentence Analogy measured in the beginning of the study still provided a significant unique contribution in the number of words ending in ‘-ice’ / ‘-isse’ suffixes that were accurately discriminated, twelve months later.

In the last set of regressions, the same analyses were performed for ‘-ice’ – ‘-isse’ pseudo-words.

Table 7.14: Summary of Two Fixed Order Hierarchical Multiple Regressions for Word Analogy and Sentence Analogy in Session A, Predicting Discrimination of ‘-ice’ / ‘-isse’ Pseudo-words in Session C

Outcome measure: Discrimination of ‘-ice’ / ‘-isse’ Pseudo-words in Session C					
Predictors					
In Session A	r ² change	B	SE B	β	Sig.
Order entered:					F Change
1 – Grade	.094	1.58	.363	.307	.000***
2 – IQ	.105	.159	.033	.326	.000***
3.1 – WA	.002	.104	.168	.058	.537
3.2 – SA	.009	.181	.128	.124	.160
p<.05; ** p<.01; *** p<.001					

In these regressions, Grade and IQ are the only significant contributors to explain discrimination of pseudo-words, twelve months later. Neither Word Analogy nor Sentence Analogy provided significant variance to the regression equations.

To conclude, after controlling for shared variance explained by Grade and IQ, significant contributions of morphological awareness were found over periods of 6 and 12 months. Sentence Analogy in Session A significantly predicted discrimination in Session B either in the spelling of words and pseudo-words. Sentence Analogy and the Pseudo-word Interpretation in Session B significantly predicted discrimination in Session C, again in words and pseudo-words. Finally, Sentence Analogy in Session A predicted the level of

discrimination of words, twelve months later, in Session C but no significant prediction appeared in the spelling of pseudo-words.

7.5.3 - Summary of results

1- The first hypothesis in this study was that correct assignment in the spelling of words and pseudo-words ending in the homophone suffixes ‘-ice’/ ‘-isse’ would follow a series of three spelling phases (Bryant 2002): 1) one-pattern-only for the two suffixes, 2) two-patterns unsystematically assigned, 3) two-patterns systematically assigned.

The study provided evidence that, after learning about basic sound-letter conventions, children go through the first two phases predicted by the model (Bryant, 2002). However, there is little evidence that the older children could achieve the last phase at the end of four years of schooling. Despite that, spelling phases correlated positively and significantly with age and the majority of children stayed or progressed through the phases proposed in the model.

2 – The study also supported the second hypothesis, that the ability to use discrimination in the spelling of the ‘-ice’/ ‘-isse’ suffixes increases with grade and session.

3 – The third hypothesis was, again, supported. Discrimination in the spelling of suffixes is predicted from the scores in the morphological awareness measures in earlier sessions. This prediction is specific because the morphological awareness measures account for unique variance after controlling for variance explained by Grade and IQ. It was found that discrimination of ‘-ice’/ ‘-isse’ Words and of Pseudo-words in Session B can be predicted from the scores of Sentence Analogy, measured six months earlier. Similarly, the Sentence Analogy and the Pseudo-word Interpretation tasks measured in Session B allowed the

prediction of the discrimination scores of Words and Pseudo-words in Session C. Finally, the scores of Sentence Analogy in Session A predicted children's performance in discrimination of Words, twelve months later.

7.6 – DISCUSSION AND CONCLUSIONS

This study demonstrated that 6- to 9-year-old children progressed in their ability to use discrimination in the spelling of words and pseudo-words ending in the homophone suffixes '-ice' / '-isse'. This progress involved the use of progressively more sophisticated approaches. After an initial period in which pre-phonetic spellings are used, children try to represent the sounds in the two suffixes with a simplified approach – the use of one-pattern-only for both suffixes. Then, as they realise that there is more than one way to represent that sequence of ending sounds, new patterns are introduced. Children do not appear to make this choice based on an explicit awareness of the grammatical rules, first. For this reason, the spellings tend to be assigned to right and wrong positions, irrespectively of the grammatical status of the words. This study shows that progress above this phase is difficult for the greatest number of 9-year-olds, those at the end of Grade 4.

The study suggests that going through the spelling phases is not a random process and there is a similar trend in the use of spelling phases both in words and pseudo-words.

A clear relation between spelling phases and age was found and the majority of children stayed in the same phase, or progressed to more advanced ones. Although desirable, it is very difficult in a developmental model that all children progress. Nunes et al. (1997, a) also found some backsliders in their longitudinal study and hypothesised that these children might make normal progress initially and then, as a result of poor experience with reading, loose confidence in their understanding of grammar distinctions. The present study cannot provide a

full explanation to why approximately 13 % of the children regressed. It is possible that regression from the unsystematic use of two patterns to the systematic use of just one pattern will not be necessarily a setback. This may indicate that the child was not able to find a rule that assured him or her a higher probability of being well succeeded. Going back to the use of one pattern (if a correct morphologically representation of one of the suffixes) assures 100 % chance of being correct in one of the ending suffixes. Possibly, the children are not aware of this but have built up a probabilistic rule of spelling, through instruction and spelling experience. Using two spelling patterns, if wrongly assigned, lowers the probability of success even further. This may also represent progress if two patterns that were just acceptable phonological representations of the suffixes are being replaced for one right morphological representation of the suffixes. Exploratory analysis of the individual scores of the children who regressed suggests that this might sometimes be the case, although more research is needed.

The pattern of predictions that was identified clearly supports that there is a strong link between morphological awareness and the ability to discriminate the spelling of suffixes. Sentence Analogy in Session A significantly predicted discrimination in the spelling of words and pseudo-words 6 months later. The Sentence Analogy and the Pseudo-word Interpretation Tasks in Session B similarly predicted spelling discrimination 6 months later, both in words and pseudo-words. Sentence Analogy in Session A significantly predicted discrimination 12 months later in the spelling of words.

The Word Analogy Task in Session B approached significance in predicting discrimination in the spelling of '-ice' / '-isse' words in Session C. This was the only time in which a significant contribution from Word Analogy was approached. This might be related to the fact that the grammatical status of the stimuli is less salient when sentence context is not provided

as in the case of Word Analogy Task. The highly consistent trend of predictions in the other two measures clearly suggests that what children know about grammatical transformations and their ability to access, identify, and interpret the meaning of stems and affixes has a specific effect on their ability to spell homophone suffixes morphologically. Such effect cannot be explained by the concurrent contribution of Grade and IQ. This demonstration in another alphabetic language - Portuguese - adds support for findings in other languages such as English (Bryant et al, 1997; Carlisle, 1988; Nunes et al., 1997 a, b; Rubin, 1988) and Greek (Aidinis, 1998) for the causal role of morphological awareness in the development of morphological spelling strategies. It must be acknowledged that the evidence provided in this study is indicative of some of the initial and intermediary complexities of the process of constructing morphological discrimination of homophone suffixes. More evidence is needed on the achievement of a complete morphological strategy that allows for systematic discrimination in the spelling of these suffixes. More evidence is also needed that the spelling of pseudo-words is informed by morphology. This is the ultimate test that a morphological rationale, not based on lexical knowledge, is attained. In order to achieve that, one needs to analyse how older children and adults develop discrimination of homophone suffixes, and whether or when systematic assignment of the suffixes is reached. This is the object of the next study.

Chapter 8

Study 6 - Consistency in the spelling of stems and discrimination of homophone suffixes by older children and adults

8.1 - RATIONALE

The aim of this study is to analyse whether or not older children and adults reach full consistency in the spelling of stems and systematic discrimination in the spelling of homophone suffixes.

The longitudinal study, reported in Chapters 5, 6 and 7, showed that first to fourth grade children improved their ability to spell morphologically related stems consistently. At the end of the study, children in grades three and four were spelling stems consistently above chance level but there was still much ground for improvement until consistency was systematic.

The study also showed that children improved their discrimination of homophone suffixes as schooling progressed. They moved from a more frequent use of just one spelling for both suffixes in earlier grades, to a more frequent use of more than one pattern in later grades. However, only a very small number of children reached systematic assignment when spelling words and no children spelled the suffixes systematically in pseudo-words. These floor effects for systematic assignment of homophone suffixes were not expected.

Some studies have pointed out that children learn beyond what is covered by formal instruction. Bryant et al.(2000) and Nunes et al. (1997, a, b) showed that children learn

a great deal on their own about morphological spelling rules. Nagy & Anderson (1984) and Wisocki & Jenkins (1987) showed that in no way could formal instruction account for the number of words that children learn. Nunes, Schlieman & Carraher (1993) also showed that children learned sophisticated mathematical knowledge, informally. If this is true, there was a legitimate expectation that more children would have figured out ways to discriminate the spelling of the suffixes systematically. It was also expected that at the end of the first four years of compulsory education in Portuguese primary schools more children would master the spelling of these suffixes to a satisfying level of accuracy, at least in words.

In order to understand when consistency in spelling stems and discrimination of homophone suffixes were systematic, it was necessary to examine spellings by older children.

Thus, this study examines the hypothesis that older children will eventually find out the underlying morphological rules.

It was also decided to take this search further examining how teachers would spell these words and how they justified their spelling choices. This was motivated by the need to check use and awareness of morphological rules by teachers. One possibility was that they were not aware of the morphological rules but, anyhow, could spell the words accurately by using lexical and spelling knowledge accumulated throughout their instruction, teaching experience, or literacy involvement. In this circumstance, transfer of knowledge into the spelling of pseudo-words could be expected if they made accurate analogies with words from the same grammatical category. A second possibility was that they had explicit knowledge of the morphological rules involved and, therefore, use those rules to spell pseudo-words systematically. Finally, teachers could show some

fragmentary knowledge of the morphological rules. That would enable them to spell some words accurately but not others because not all the contexts to which a rule applies were understood. Accordingly, incomplete transfer could occur in the spelling of pseudo-words.

Only by asking teachers' justifications for their spelling choices, could one gather information about their awareness and use of morphological rules.

8.2 – PARTICIPANTS

The participants were 74 children from grades five, seven and nine and 33 adults (N = 107).

There were 22, 25 and 27 children, in grades five, seven and nine, respectively. They were sampled as whole groups, according to time availability on the days of testing and willingness from their teachers to let them participate. All the children came from one school in the same catchment area as those that had participated in the longitudinal study. This school provides instruction from grades five to nine.

There were also two groups of adults, 14 student-teachers and 19 in-service teachers. The first group comprised primary school student-teachers who were about to finish their graduation and were subsequently going to enter the teaching profession. They had no teaching experience other than the supervised tuition that took place during the four years of their training at the School of Education. Student-teachers have 12 years of primary and secondary studies and 4 years of graduation at the School of Education - a Polytechnic School with the same status as universities. The second group was formed by 19 in-service teachers who were enrolled in further training, in the same school, for professional accreditation. These teachers of different subject areas (Sciences, History,

Maths, Portuguese) were already working in schools for some years (Mean age = 30.68; Range: minimum = 25; maximum = 44). In-service teachers have 12 years of primary and secondary studies, plus 4 to 5 years at University. Their degree at the University may not provide accreditation as a teacher. They are allowed to teach but have to undergo further training. Successful completion of this training has an impact on their professional status and career stability.

The experimenter had never been involved in any training or lecturing activities with any of the groups.

Table 8.1 displays the participants’ mean age and standard deviations, in years.

Table 8.1: Mean Age in years and Standard Deviations (in brackets) of Participants

Level of instruction	Mean age	(SD)	N
Grade 5	11.09	(0.87)	22
Grade 7	12.96	(0.98)	25
Grade 9	14.81	(0.96)	27
Student Teachers	22.50	(1.61)	14
In-service Teachers	30.68	(5.00)	19

All children and adults had European Portuguese as their first language and no diagnosed impairments. The data were collected at the end of May 2002, approaching the end of the school year.

8.3 DESIGN

In this study the main factor was level of instruction (Grades five, seven, nine, student-teachers, in-service-teachers), and the dependent variables were:

1 - Consistency in the spelling of stems:

1.1 – Base / Derived Words

1.2 - Base / Pseudo-derived stimuli

2 - Discrimination in the spelling of homophone suffixes:

2.1 - ‘-esa’ / ‘-eza’ words

2.2 – ‘-esa’ / ‘-eza’ pseudo-words

2.3 - ‘-ice’ / ‘-isse’ words

2.4 – ‘-ice’ / ‘-isse’ pseudo-words.

The use of pseudo-words controls for lexical effects because accurate spelling can only be achieved if morphology of the stem or the grammar category of the suffixed stimuli is considered.

The dependent variables will be analysed quantitatively for the significance of the mean differences, by level of instruction. A second quantitative analyses will examine the spelling of suffixes as categories or spelling phases. Finally, a qualitative analysis will examine teachers’ justifications for their spelling choices.

This provides information on teachers’ explicit knowledge of the morphological rules involved.

Justifications from student-teachers will be asked after the spelling of pseudo-words and words is performed. This allows them to use lexical information of words to look for reasons that underlie their spelling choices.

Justifications based on the spellings of pseudo-words only, will be asked from in-service teachers. This evaluates whether morphological rules can be accessed in the absence of lexical information, by identifying from sentence context, which is the grammar status of the pseudo-word. Because these justifications can raise their awareness of the underlying morphological rules, these more experienced teachers will not be asked to spell words.

The questions will be framed in such a way that will not provide feedback as to whether each specific spelling was correct or wrong.

Thus, this design provides quantitative analysis on levels of consistency in the spelling of stems, on discrimination in the spelling of homophone suffixes, and on use of spelling phases. Furthermore, qualitative analysis will be performed on teachers' justifications about the spelling choices used in the discrimination of homophone suffixes.

8.4 – MATERIALS AND PROCEDURE

The participants were asked to spell the same stimuli used in the longitudinal study (for a detailed description of the task, please refer to chapter 4). Children in Grades 5, 7 and 9 as well as student-teachers spelled the whole spelling task (96 stimuli). In-service teachers spelled only half of the spelling task, the part related to pseudo-words (48 stimuli).

The task was administered collectively to each group, in one session. The spelling task is listed in Appendix 4.1.

When the spelling task was completed, the student teachers were asked to write an answer for three direct questions: *'Can you please explain, briefly:*

1 – Why are some words that end in the sound /eza/ spelled with [-esa] and others with [-eza]? 2 - Why are some words that end in the sound /is/ spelled with [-ice] and others with [-isse]? 3 – How can children learn and be taught about these distinctions?'

These questions were presented orally. While presenting the first question, the experimenter wrote the homophone suffixes [-esa] and [-eza] on the board and did the same for the suffixes [-ice] and [-isse] while reading the second question.

When the in-service teachers finished the spelling of the pseudo-words they were told, orally: *'Could you please circle two pseudo-words ending in the sound /eza/ and two pseudo-words ending in the sound /is/ and write down why you spelled them in that way?'*

Before they started writing down their justifications the experimenter went round the classroom and asked each in-service teacher whether he or she would like that the sentences containing the circled pseudo-words were re-called. This was intended to allow them access to the sentence context necessary to identify the grammar status of the pseudo-words. However, no comment about the need to consider the grammar status of pseudo-words was made. The sentences with the selected pseudo-words were re-read to each teacher that requested it.

Justifications were not asked from children, because of time constraints.

8.5 RESULTS

8.5.1 – Analyses of scores as continuous variables

8.5.1.1 - Analyses of reliability and skewness

In order to analyse whether the answers on the items in the spelling task were internally reliable, Cronbach's Alphas ($p < .05$) were computed on correct / wrong scores in each of the items. This analysis was needed to assess whether the task was responded by older subjects in a coherent way. An Alpha = .89 was found for the whole spelling task. This included scores in 16 pairs of items examining consistency in the spelling of stems, scores in 32 items assessing discrimination in the spelling of suffixes '-esa' / '-eza' (words and pseudo-words) and 32 items assessing discrimination in '-ice' / '-isse' suffixes (words and pseudo-words). Alphas on each of these three sub-parts of the scale were also computed to further investigate the internal consistency in each group of stimuli from where the dependent variables were derived. Alphas of .81 for consistency in the spelling of stems, .84 for discrimination of '-esa' / '-eza' suffixes and .87 for discrimination of '-ice' / '-isse' suffixes were found. Thus, it can be concluded that the spelling task as a whole and in each of its sub-parts was highly reliable. All Alphas are well above .70, the minimum proposed by Kline (1993).

The scores in each of the dependent variables were then analysed for skewness of the distributions. A significant negative skewness was found for Consistency in the Spelling of Stems in Base – Derived pairs ($z = -3.86$), for Consistency in the Spelling of Stems in Base – Pseudo-derived pairs ($z = -4.30$) and for Discrimination of '-esa' / '-eza' Words ($z = -4.58$). In the other dependent variables the distributions were normal with values of $z = -0.06$ for Discrimination of '-esa' / '-eza' Pseudo-words, of $z = -1.84$ for

Discrimination of ‘-ice’ / ‘-isse’ Words and of $z = -0.48$ for Discrimination of Pseudo-words ending in ‘-ice’ / ‘-isse’ suffixes.

In order to avoid effects from lack of symmetry of the three skewed variables, these were normalised by the Rank / Normal / Blom method. After that, all variables showed a non-skewed distribution with $z = -1.92$ for Consistency in the Spelling of Stems in Base – Derived pairs, $z = -1.93$ for Consistency in the Spelling of Stems in Base – Pseudo-derived pairs and $z = -0.37$ for Discrimination of ‘-esa’ / ‘-eza’ Words.

The normalised scores in these three dependent variables will be used in all subsequent analyses.

8.5.1.2 - Analyses of means and standard deviations

Total scores for each dependent variable were computed following the criteria used in the longitudinal study. The maximum possible score was 8 for each of the two variables assessing Consistency in the Spelling of Stems. The maximum possible score for each of the variables related to the spelling of suffixes was 16. This meant that all 16 items had been systematically assigned. The minimum possible scores were zero (0) for consistency in the spelling of stems and –16 for discrimination in the spelling of suffixes. The range of scores for discrimination of suffixes (from -16 to 16) derived from applying Guilford’s correction for chance formula (Guilford, 1954), as reported in the longitudinal study.

Table 8.2 displays the means and standard deviations that were found for the two variables assessing Consistency in the Spelling of Stems.

Table 8.2: Means and standard deviations (in brackets) for Consistency in the Spelling of Stems in Base – Derived pairs and in Base – Pseudo-derived pairs, by Level of Instruction.

	Dependent variables	
	Consistency in the Spelling of Stems	
	Base –	Base –
	Derived	Pseudo-derived
Level of instruction	M (SD)	M (SD)
Grade 5 (N = 22)	5.27 (1.64)	5.64 (1.71)
Grade 7 (N = 25)	6.68 (1.44)	6.44 (1.47)
Grade 9 (N = 27)	7.41 (.84)	7.48 (1.01)
Student Teachers (N = 14)	7.92 (.29)	7.42 (.79)

Note: The scores range from 2 to 8, the maximum possible score, in both variables

The pairs of Base – Derived words were formed by two real words such as the base form ‘areia’ (the sand) and the derived form ‘areal’ (sand shore). As Table 8.2 shows, the ability to spell these stems consistently improves with grade. At the end of the longitudinal study, children in Grade 4 were spelling, on average, 5.08 pairs

consistently, out of 8. In this study, children from Grade 5 to 9 continue to make progress. In Grade 9 children reach ceiling level, spelling 7.41 pairs of stems consistently, out of 8.

Exactly the same pattern of results appears in the spelling of pairs of stems in Base – Pseudo-derived forms. In this case, Base forms are real words such as ‘tambor’ (the drum) and Pseudo-derived forms are made of a real stem (‘tambor’) plus a real suffix (‘-eiro’) in a combination (‘tamboreiro’) that does not exist in the language. Children in Grade 4 at the end of the longitudinal study spelled, on average, 4.98 pairs of stems consistently, out of 8. A linear improvement is found from grades five to nine. Children in grade nine reach ceiling.

This suggests that achieving consistency in the spelling of stems is a long process that children start when they enter school and finish by the end of Grade 9.

In the next table, the means and standard deviations for discrimination in the spelling of words and pseudo-words ending in homophone suffixes are displayed.

Table 8.3: Means and Standard Deviations (in brackets) for Discrimination in the Spelling of Words and Pseudo-words Ending in Homophone Suffixes, by Level of Instruction

Level of instruction	Dependent variables			
	ESA/EZA	ESA/EZA	ICE/ISSE	ICE/ISSE
	(W)	(PW)	(W)	(PW)
	M (SD)	M (SD)	M (SD)	M (SD)
Grade 5 (N = 22)	7.00 (4.40)	-2.64 (5.70)	4.81 (3.81)	3.44 (3.37)
Grade 7 (N = 25)	11.04 (3.70)	1.36 (4.96)	8.55 (5.55)	5.40 (4.62)
Grade 9 (N = 27)	11.63 (1.84)	2.74 (3.97)	10.40 (3.01)	6.74 (3.18)
Student Teachers (N = 14)	13.00 (2.04)	.67 (5.74)	15.38 (1.07)	9.23 (3.59)
In-Service Teachers (N = 19)	*	2.11 (4.97)	*	9.36 (3.44)

Notes:

- * Data not available because in-service teachers only spelled pseudo-words.
- The discrimination scores range from – 4 to16 in ESA/EZA Words, from -14 to14 in ESA/EZA Pseudo-words, from –2.75 to 16 in ICE/ISSE Words and from – 4 to 16 in ICE/ISSE Pseudo-words.

Table 8.3 shows that there is a clear progression in Discrimination of Words ending in ‘-esa’ / ‘-eza’. At the end of the longitudinal study, children in Grade 4 showed a positive discrimination score of 6.34. This indicates that their spelling of the two suffixes was not random and that they were attempting to introduce discrimination in a more precise way. However, they were still away from a stage of systematic discrimination. The results on Table 8.3 show that there is improvement with level of instruction but that such improvement is particularly impressive from Grades 5 to 7. Then a plateau is reached until Grade 9. Student-teachers, with a mean discrimination score of 13.00 approach systematic discrimination (a score of 14 or more would indicate systematic discrimination under the criterion of 7 out of 8 correct in each suffix). A closer look at the distribution of frequencies indicates that 57.2 % of the student-teachers are systematically correct with a score equal or higher than 14.00 but that the remaining 42.8 % have a mean score of 12.00 or less (minimum score = 10.00). The finding that some student-teachers can not discriminate the spelling of words with these suffixes systematically is unexpected and surprising.

The mean scores of discrimination of pseudo-words ending in ‘-esa’ / ‘-eza’ show a pattern that is also consistent with what had been found previously. In the longitudinal study, the older children had not yet reached a positive discrimination. Children in grade five continue with negative discrimination but a slight progress is made in grades seven and nine. The means for discrimination in the two groups of teachers do not appear to be consistently different from the means reached by children in grades seven and nine.

This suggests that at no level of instruction are morphological rules clearly accessed. Spelling justifications by teachers will provide information on how the spelling of pseudo-words is processed.

Discrimination of ‘-ice’ / ‘-isse’ words and pseudo-words, both show a similar trend of continuity from the mean scores observed in the longitudinal study. At the end of the longitudinal study, children in Grade 4 showed a mean positive discrimination score of 4.05 for the spelling of suffixes in Words and of 2.87 in the spelling of pseudo-words. In this study, children in grade five, showed some progress. In the spelling of words, there is a marked improvement from grades five to seven. Improvement is not as marked in pseudo-words. Children in Grade 9 do not achieve complete discrimination in any of the two variables. Student-teachers reach systematic discrimination in the spelling of words. Neither the student-teachers nor the in-service teachers can, however, reach discrimination in the spelling of pseudo-words.

These results displayed in Tables 8.2 and 8.3 indicate that consistency in the spelling of stems is acquired first than discrimination of homophone suffixes. Secondly, children in grade 9 achieve consistency in the spelling of stems but can not achieve systematic discrimination of any of the suffix pairs. The mean scores also indicate that ‘-ice’/ ‘-isse’ suffixes are easier to master by teachers than ‘-esa’/ ‘-eza’, and that knowledge used for discriminating the spelling of suffixes in words is not transferred to the spelling of pseudo-words.

8.5.1.3 – Analyses of the significance of mean differences

In order to analyse whether the above suggestions are statistically meaningful, One-way ANOVAs were conducted on the means of each dependent variables with level of instruction (grades five, seven and nine, student-teachers and in-service-teachers) as the main between-subjects factor. Because in-service teachers did not spell words, there were only four levels of instruction in the spelling of words (grades five, seven, nine

and student-teachers) and five in pseudo-words (grades five, seven, nine, student-teachers and in-service teachers).

The analysis of the effects of level of instruction was followed by inter-group comparisons using Student-Neuman-Keuls post-hoc tests.

Table 8.3 summarises the results that were found.

Table 8.3: Summary of results of One-way analyses of variance (ANOVA) on the dependent variables with level of instruction as the main factor and inter-group comparisons by Post-hoc Student-Newman-Keuls tests ($p < .05$)

Dependent Variables	F (df) =....., p <.....	Post-hoc SNK tests
Consistency (stems):		
- Base – Derived	F (3,82) = 15.86, p < .001*	Gr 5 < Gr 7 < Gr 9 = ST
- Base – Pseudo-derived	F (3,82) = 10.29, p < .001*	Gr 5 = Gr 7 < Gr 9 = ST
Discrimination:		
- esa/eza words	F (3,84) = 11.66, p < .001*	Gr 5 < Gr 7 = Gr 9 = ST
- esa/eza pseudo-words	F (4,100) = 4.02, p = .005	Gr 5 < Gr 7 = Gr 9 = ST = IST
- ice/isse words	F (3,84) = 21.80, p < .001	Gr 5 < Gr 7 = Gr 9 < ST
- ice/isse pseudo- words	F (4,100) = 8.79, p < .001	Gr 5 < Gr 7 = Gr 9 < ST = IST

Notes:

- Gr 5 = Grade 5; Gr 7 = Grade 7; Gr 9 = Grade 9; ST = Student-teachers; IST = In-service teachers.
- (*) Analysis of variance using normalised scores (Rank / Normal / Blom method)

This table shows that there is a significant effect of level of instruction (Grade) in all dependent variables. This analysis was followed by Post-hoc SNK tests ($p < 0.05$) in order to examine significant differences between the different levels of instruction.

These tests revealed that:

- Children in grade five, spelled stems consistently in Base – Derived forms less effectively than children do in grade seven. These, in turn, were less effective than children in grade nine that were at ceiling level. Student-teachers were also at ceiling.

As to consistency in the spelling of stems in Base – Pseudo-derived forms, performance of children in grades five and seven did not differ but consistency was at ceiling in grade nine and in student-teachers.

- Children in grades five were significantly less accurate in discrimination of ‘-esa’ / ‘-eza’ words than children in grades seven and nine. Although the mean scores of the student-teachers are higher than in grade nine, this difference was not significant. This indicates that a plateau is reached by the end of grade seven, and that significant progress is very hard to achieve, thereafter.

The pattern for discrimination of ‘-esa’ / ‘-eza’ pseudo-words is quite clear in that neither children nor the two groups of teachers were successful in using morphological rules to spell these pseudo-words. Only children in grade five performed at a significantly lower level of discrimination than all other groups but, in any case, the discrimination scores were extremely low.

This suggests that, despite the fact that lexical knowledge provides much of the information required to discriminate the spelling of words, such knowledge is not transferable into pseudo-words.

- Discrimination of ‘-ice’ / ‘-isse’ words presented probably the most homogeneous trend. There are three groups. Children in grades five are significantly less accurate than children in grades seven and nine. Only student-teachers reached complete discrimination. This suggests that significant progress is done up to grade seven. Then, up to grade nine, children can not go much further. Student-teachers show discrimination at the end of 16 years of instruction (12 years of primary and secondary studies and four years at the university).

As for discrimination of ‘-ice’ / ‘-isse’ pseudo-words a similar pattern was found. The only significant difference is between grades five and seven. The mean scores of children in grade nine were not significantly higher than those in grade seven. The two groups of teachers had significantly higher mean scores than children in grades seven and nine. However, their mean scores are far from ceiling. This, again, indicates that progress is made, up to grade seven, but no significant progression is apparent afterwards. Lexical knowledge that student-teachers had used in the spelling of words could not be transferred to pseudo-words. The mean scores obtained by in-service teachers were not significantly different from those of student-teachers despite differences in teaching experience.

8.5.2 – Analyses of scores as categories: the spelling model

Similarly to the analysis done in the longitudinal study, it was examined what types of spelling phases older children and teachers used when attempting to discriminate the spelling of words and pseudo-words ending in homophone suffixes. The aim of this analysis was to further understand whether the model of spelling phases summarised in

Bryant (2002) would still apply when looking at spellings that were progressing towards systematic discrimination.

8.5.2.1 – Phases of spelling used in words and pseudo-words ending in homophone suffixes

Phases of spelling were computed in each one of the dependent variables related to discrimination in the spelling of suffixes, using the same criteria as in the longitudinal study. A detailed description of the developmental criteria used to derive spelling phases in ‘-esa’/ ‘-eza’ and ‘-ice’/ ‘-isse’ homophone suffixes can be found in Chapters 6 and 7, respectively.

Figure 8.1 displays the results of phases of spelling for discrimination of ‘-esa’ / ‘-eza’ words.

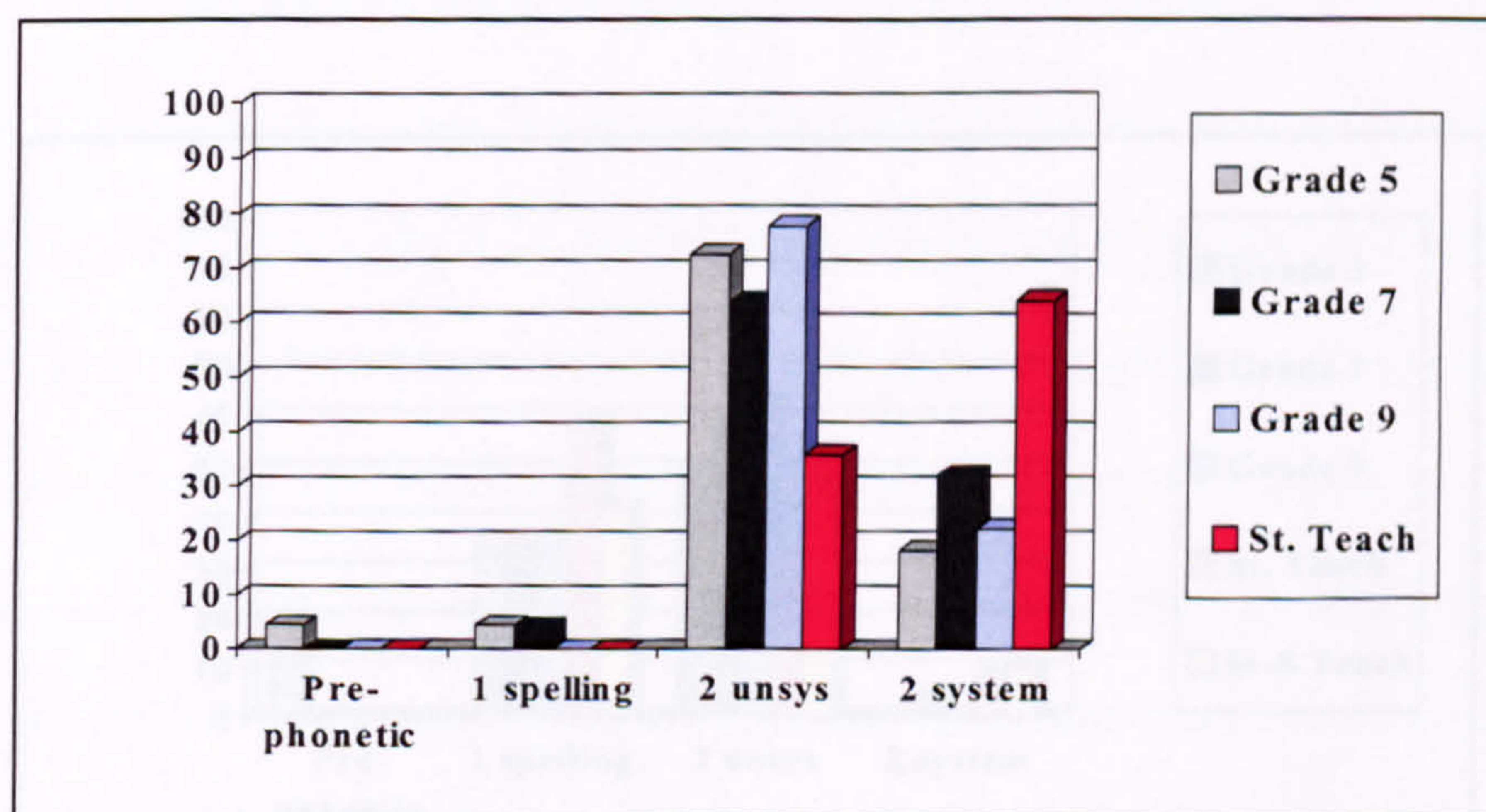


Figure 8.1: Percentage of use of Patterns of Spelling in ‘-esa’ / ‘-eza’ words, by Level of Instruction

This figure shows that children in grades five seven and nine tended to use two spelling patterns, unsystematically, in the larger percentage of spellings. This means that children are using spellings that conform to good phonological representations for the suffixes but that are not yet assigned to the correct contexts only. The table also shows that children systematically assign only 20 to 30 % of the spellings.

More than 60 % of the spellings are systematically discriminated by student-teachers, although the remaining are still unsystematic.

The use of only one spelling for the two suffixes is no longer relevant for older children or adults.

Figure 8.2 displays the spelling patterns used in ‘-esa’ / ‘-eza’ pseudo-words.

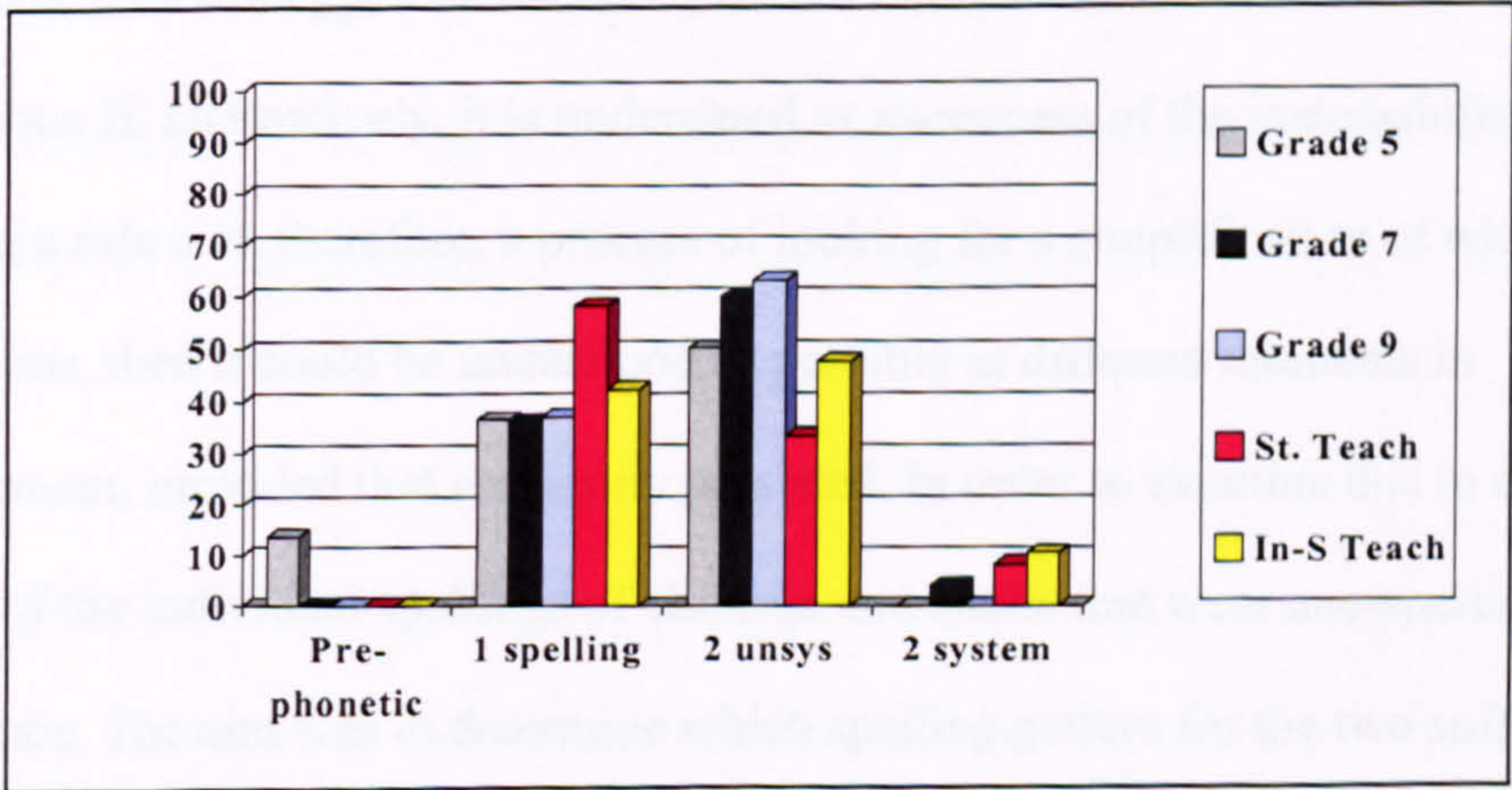


Figure 8.2 - Percentage of use of Patterns of Spelling of ‘-esa’ / ‘-eza’ pseudo-words, by Level of Instruction

The above figure shows a dramatic change in how pseudo-words are spelled. There is a move to strategies that children are supposed to have used earlier, such as using just one spelling pattern for the two suffixes. This move is not characteristic of older children, since it also occurs with teachers, independently of their degree of professional experience. Student-teachers have even the highest percentage of one-spelling for the two suffixes, which is quite surprising.

Then, the other strategy consists on using two-patterns but unsystematically assigned and only a non-relevant percentage of spellings are systematic.

Thus, it seems that, although student-teachers showed a higher degree of discrimination in the spelling of words, they can not derive the morphological rules that apply there and transfer those rules to the spelling of pseudo-words.

The occurrence of a considerable percentage of one-spelling users even in student-teachers raises the issue of the developmental nature of this strategy. If it is conceived as a less advanced strategy, then its use by older children and adults could not be reasonable. If, alternatively, it is understood as awareness of the impossibility of deriving a rule and, therefore, a process of looking for a simplification of what is ambiguous, then it could be understood as possible in different moments in development, provided that ambiguity persisted. In order to examine this in detail, reports of the individual spellings of children and adults that were one-spelling users were made. The aim was to determine which spelling pattern for the two suffixes ‘-esa’ or ‘-eza’ was prevalent across levels of instruction. The patterns in ‘-esa’/ ‘-eza’ pseudo-words were chosen because, there, contamination by word knowledge is controlled and ambiguity is probably at its highest, as suggested by the floor effects that were obtained in the longitudinal and in the present studies.

Figure 8.3 displays the results that were found. In this figure the first three series of columns refer to the results of children in the last session of the longitudinal study, when they were at the end of grades two, three and four. This is done to allow for comparability of strategies across the two studies and because a shift in spelling strategies would not be apparent if the initial grades were not displayed.

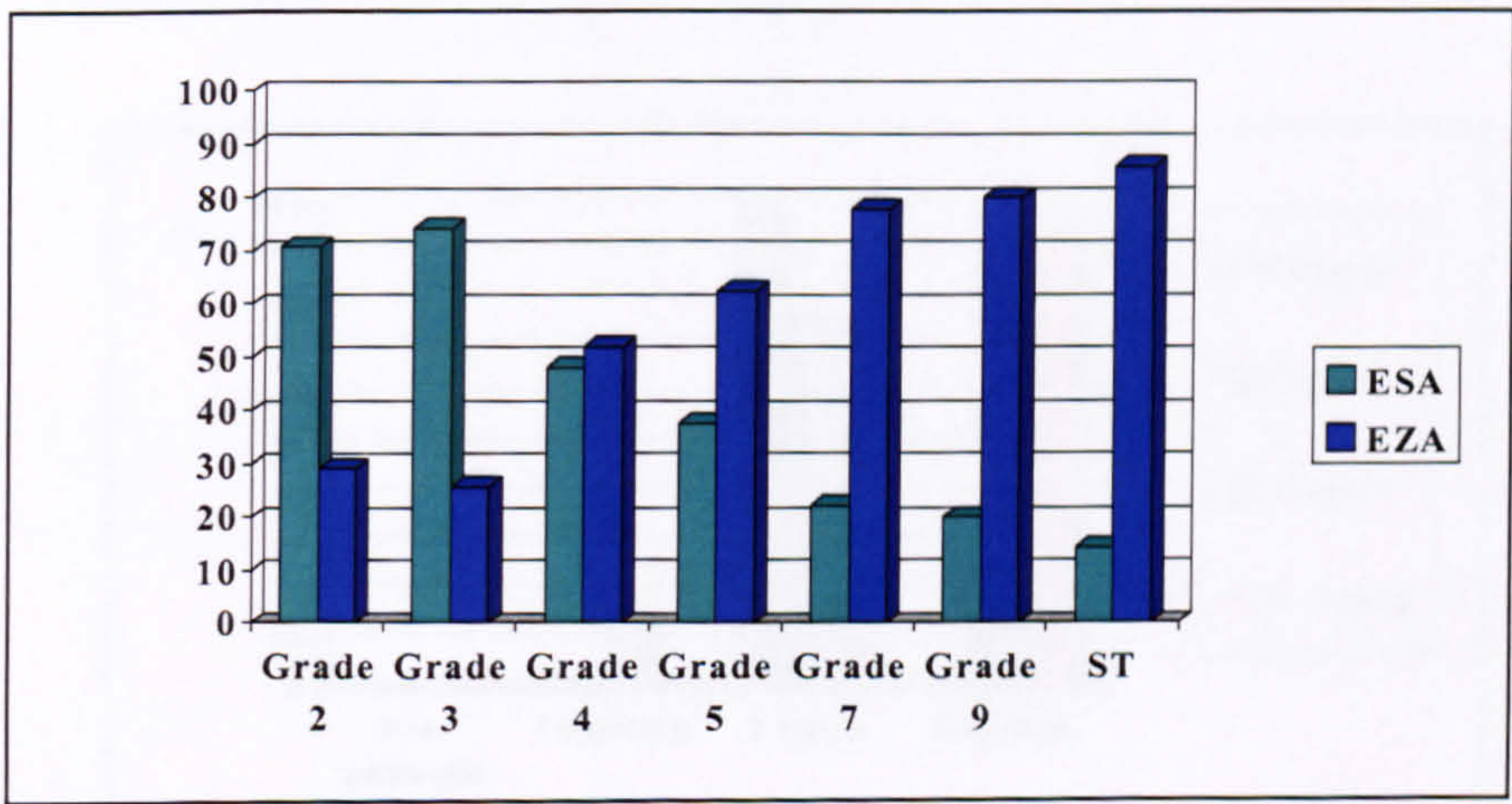


Figure 8.3: Percentage of one-pattern-users that used either ‘-esa’ or ‘-eza’ as their preferred spelling pattern in ‘-esa’ / ‘-eza’ Pseudo-words, by level of instruction.

The figure shows that the greatest percentage of children that are one-spelling users in grades two and three use ‘-esa’ as their pattern of choice. In grade four the two patterns are levelled and, thereafter, children and adults shift to the use of ‘-eza’ as the prevailing pattern when a reason can not be found to allow discrimination of suffixes.

The first pattern ‘-esa’ is based on contextual rules that children learn and ‘-eza’ is a pattern more in line with a phonological representation for the sounds in the suffix. This

issue will be considered again in the discussion trying to explain why some children appear not to start with a phonological approach. Similarly, it will be explained why some older children and, indeed, adults use a phonological approach when they find out that a contextual one is insufficient.

Figure 8.4 displays, now, the spelling phases found in the spelling of ‘-ice’ / ‘-isse’ words.

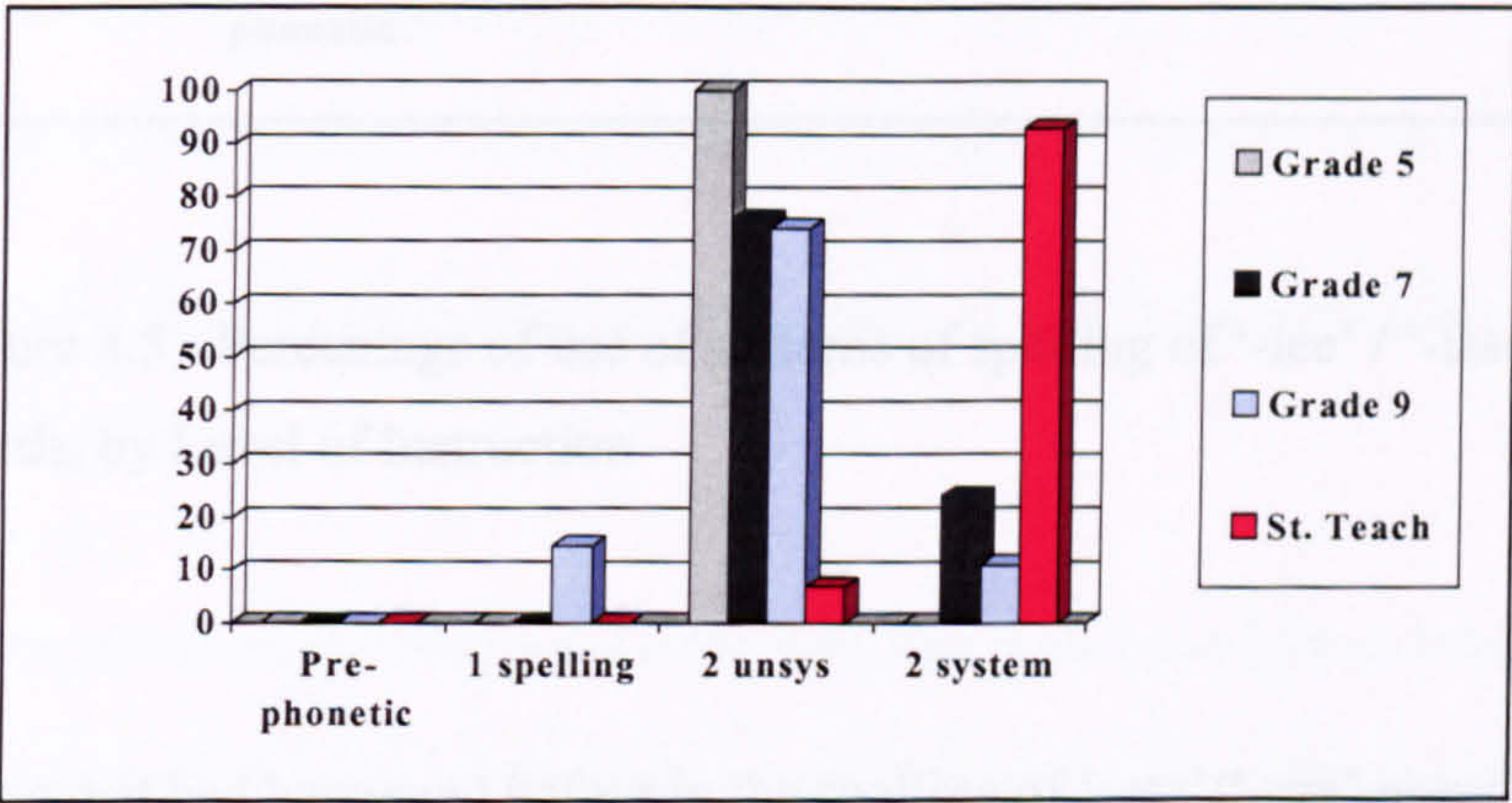


Figure 8.4: Percentage of use of Spelling Phases in ‘-ice’ / ‘-isse’ words, by Level of Instruction

There is a very clear trend here. Children use mostly two-patterns, unsystematically, and this decreases slowly as grade increases. Only a relatively small percentage of the spellings are systematically assigned by children. Student-teachers achieve systematic assignment of the suffixes.

Again, one has the opportunity to observe whether the knowledge used to spell words is transferable to the spelling of pseudo-words.

The spelling phases used in ‘-ice’/ ‘-isse’ pseudo-words are displayed in figure 8.5.

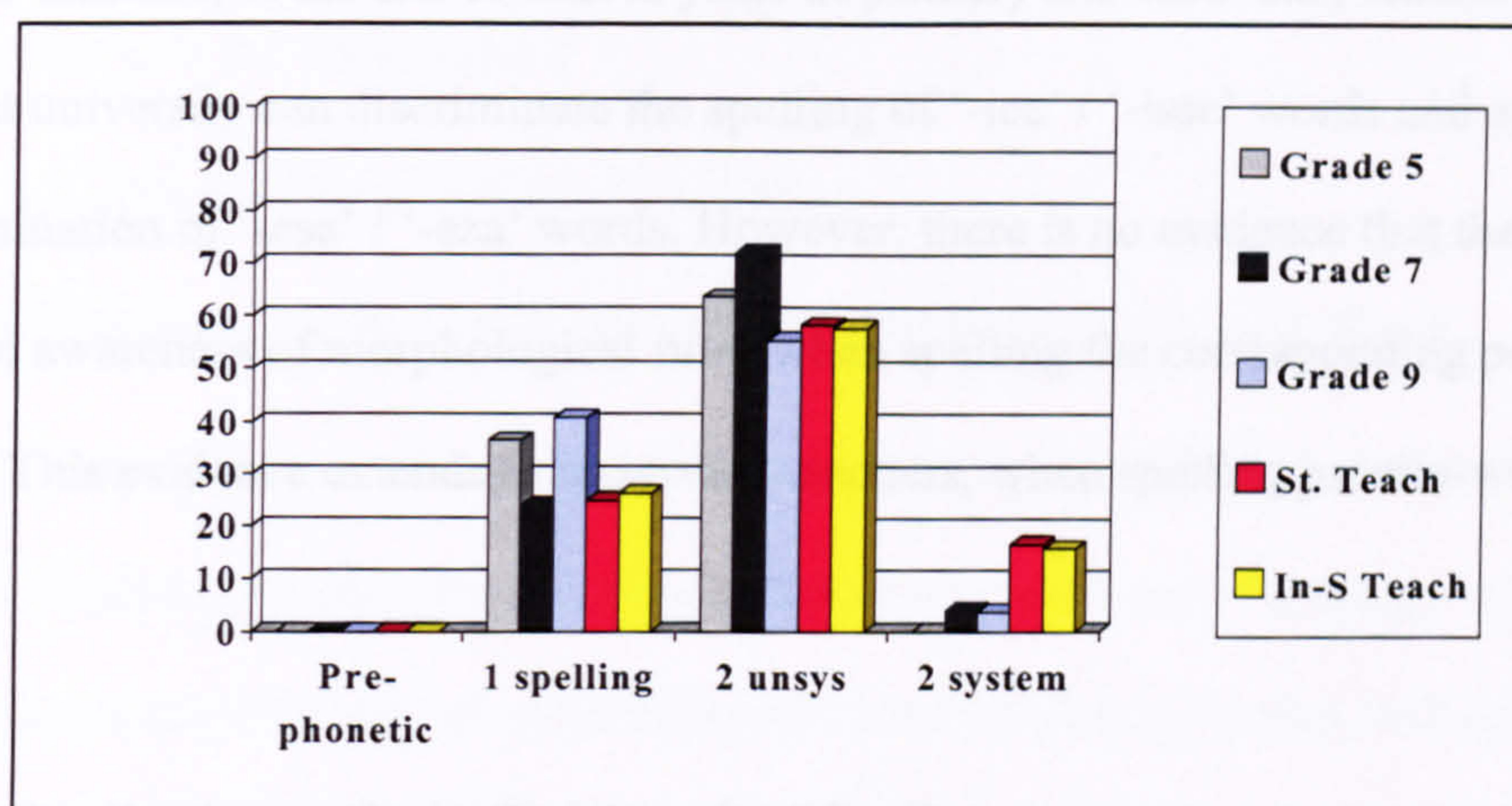


Figure 8.5 - Percentage of use of patterns of spelling of ‘-ice’ / ‘-isse’ pseudo-words, by Level of Instruction

Similarly to what had happened before in the spelling of ‘-esa’/‘-eza’ pseudo-words, a dramatic drop in systematic assignment is observed in the spelling of ‘-ice’ / ‘-isse’ pseudo-words, by teachers. The low percentage of spellings that children had systematically assigned in ‘-ice’ / ‘-isse’ words almost disappear in pseudo-words.

Again, using two spellings unsystematically appears to be the preferred alternative for all groups, although a non-neglectable percentage of the spellings conform to using just one spelling for the two suffixes.

To conclude, this analysis shows that, at the end of nine years of compulsory schooling, most children can not reach a stage of systematic assignment in any of the suffixes.

Only in ‘-esa’ / ‘-eza’ words, 20 to 30 % of the spellings are systematically assigned.

This amount drops even lower in ‘-ice’ / ‘-isse’ words. Systematic assignment of both groups of suffixes in pseudo-words is not possible for children.

Student-teachers, at the end of twelve years of primary and secondary studies plus four years at university can discriminate the spelling of ‘-ice’ / ‘-isse’ words and approach discrimination of ‘-esa’ / ‘-eza’ words. However, there is no evidence that they can bring in awareness of morphological rules when spelling the corresponding pseudo-words. This evidence extends to in-service-teachers, when spelling pseudo-words.

8.5.3 – Qualitative analysis: Teachers justifications

Many questions are left unanswered by the pattern of results found in both quantitative analyses.

Is it that accurate spelling choices are especially based on lexical knowledge and no explicit understanding of morphological rules? Could it be that a fragmentary understanding of morphological rules explains the difficulty to achieve complete discrimination when spelling words? Are there specific linguistic issues that make discrimination of ‘-ice’/ ‘-isse’ words easier than ‘-esa’/ ‘-eza’ words? Why is it that discrimination of pseudo-words follows a different trend when compared to words?

In order to understand these issues further, teachers were asked for justifications of their spelling choices. Examples of those are displayed in the following sections.

8.5.3.1 – Spelling justifications by in-service teachers

In-service teachers were asked to circle two pseudo-words ending in the sound /eza/ and another two ending in the sound /is/ and to write down why they had decided to spell

those stimuli in that way. Because no lexical information existed, it was intended to examine whether there would be knowledge of morphology involved in their spelling decisions. Examples of teachers' answers are given in italics and the actual stimuli of the spelling task are underlined.

Five types of justifications could be identified:

1 – Justifications in which some knowledge of morphology is involved.

In a first example, the spellings are both correct and the morphological rules are mostly correct. This teacher states that '*calhapice is a common noun and gapisse is a verb in the subjunctive*'. This teacher takes *calhapice* as a common noun and, in fact, is an abstract noun but the verb in the subjunctive is accurately marked. Awareness of morphological rules does make a difference in the extent to which pseudo-words are spelled. This teacher made a systematic assignment of both pairs of homophone suffixes (pseudo-words).

In a second example, the teacher wrote that '*arlineza has to do with geographic origin and valinesa is a characteristic of the subject*'. This teacher enunciates both morphological rules almost accurately. However, *arlineza* should end in '-esa' because, quite rightly, indicates geographic origin and *valinesa* should be written with '-eza' because it indicated an abstract characteristic of the subject. Thus this teacher knows and can formulate the rules explicitly but can not perform a critical task, to successfully identify the morphological status of the pseudo-word in order to apply the rule. As expected, there is a direct link between this misidentification and spelling outcome. This teacher could only discriminate six suffixes accurately, out of sixteen.

One teacher selected the pseudo-word '*Norubesa*' which is spelled correctly and explained that '*someone that inhabits at Noruba is norubês (masculine) or norubeza*

(feminine)'. This reflects knowledge that '-esa' is a suffix that indicates origin or provenance and is the feminine form for the derivational suffix '-ês'. However, it is interesting to note that in his explanation the pseudo-word's suffix is spelled first correctly and, at the end, incorrectly (my emphasis, in bold). Thus, there is a dissociation between knowing a rule and applying it consistently.

Another teacher wrote that *'vanhisse is a verb in the past, therefore is written with 'sse'*.

This is true and the fact that the verb is in the past gives some help to the spelling, but the fact that the verb is in the subjunctive past is not mentioned. A fragmentary rule like this one - 'verbs in the past, therefore '-sse' - would be unproductive if applied to all tenses in the past.

2 – Justifications involving wrong grammar classifications

These are examples of misclassifications of grammar. One teacher wrote that *'arunisse is in the conditional tense'* but in fact is the subjunctive. Another teacher wrote that *'piralice is an adjective; aronisse is in a sentence with a meaning of 'imperative'* and wrongly, they were both examples of verb forms in the subjunctive.

Another teacher selected *'arlineza' and 'pafulhesa'*. These were both pseudo-words that indicated origin or provenance and therefore should be written with '-esa'. The teacher then explains that *'it was difficult to decide whether to write [s] or [z] because the [s] between vowels has the value of /z/. So I cannot find a logical explanation'*. It is true that such rule - [s] between vowels has the value of /z/ - exists. It is a contextual rule that applies to some contexts but not to others and so the spellings in which the sound /z/ appears between vowels can not be 100% predicted from this rule. This is why the teacher can not reach an explanation that is logical. In the case of homophone suffixes,

however, the morphological rules allow for 100 % predictability, provided that an accurate grammar category is identified.

3 – Justifications based on analogy with real words

Because lexical knowledge was not available, the use of analogy to real words was a spelling strategy referred to, frequently, by in-service teachers.

One teacher stated that *'malideza was written with [z] because of the meaning that is suggested (mal + palidez = malideza)'*. He tried to segment the pseudo-word as if it was formed by a combination of two distinct real words. This process of segmentation, however, is not an accurate representation of the morphological structure of the pseudo-word. Maybe that explains why this teacher only spelled two pseudo-words ending in '-eza' accurately.

Other teachers wrote that *'malideza makes me think of beleza (beauty)';* or *'I wrote [z] in pacheza by analogy with nobreza (nobility)';* or still *'I wrote arlinesa with [s] by analogy with: she was born in Portugal = portuguesa (portuguese).'* In these examples, the real words are all accurately matched in grammar function with the pseudo-words.

As for the suffixes '-ice' / '-isse' similar examples emerged: *'I wrote piralisse'* which is correct as a verb in the subjunctive by *'association with the sentence context to permitisse (if I allowed) that is written with two [ss]'*, where 'permitisse' is a real verb in the same tense. This analogy strategy allowed this teacher to discriminate all '-isse' pseudo-words accurately.

The association with similar verb forms is also mentioned by other teachers as in the following examples: *'I wrote cafisse with [isse] by association to escapulisse (if I*

departed)', a real verb; '*I wrote piralisse - with two [ss] by analogy with similar verb forms*'.

Similar examples were found for abstract nouns formed with the suffix '-ice': '*I wrote tagonice by association to velhice (being elder)*' or '*in tagonice - I wrote [c] by analogy with gabarolice (boastful talk)*' where 'velhice' and 'gabarolice' are real abstract nouns.

The previous examples show that spelling by analogy is productive if the grammar category of the pseudo-word is correctly accessed from the sentence context. However, if only a phonological analogy to the endings of words is performed, no productive spelling choice is possible. Another teacher that wrote down the reasoning steps followed gives a clearer example of the above strategy. The sentence context indicated clearly that the stimulus 'butisse' was to be spelled as a verb in the subjunctive. This is how this teacher reasoned about this issue: '*butice = botão / burrice = ce*'. In this example, the teacher tries to access real words that have some match with the phonological characteristics of the stimulus. Firstly, he attempted to form a word that matched the initial sounds of 'butisse'. He could not reach a satisfying match because 'botão' is not acceptable as a word. Then he looked for another match that represented both the initial and the ending sounds in the pseudo-word. In fact, 'burrice' (stupidity) is a very good match that only differs from the pseudo-word by a middle consonant. Adding up both contributions, this teacher decided that the pseudo-word should be spelled as '*butice*' as if it was an abstract noun. As an expectable outcome of this inaccurate approach, only one pseudo-word ending in '-isse' was accurately discriminated.

Thus, analogy can be a useful strategy to spell pseudo-words only when the correct grammar category of the pseudo-word is identified.

4 – Justifications based on wrong phonological strategies

Identifying which grapheme corresponds to a certain sound is certainly a useful strategy when spelling words in a transparent language. However, in the case of these homophone suffixes, this is useless: the suffixes sound exactly the same but are spelled differently. Despite that, some teachers did think that ‘sounding’ is a reasonable strategy. For a matter of coherence, this strategy leads to the use of just one spelling pattern for both suffixes. This would mean a close to zero discrimination. This was stated by some teachers: *‘I wrote all words ending in the sound /eza/ with [z] because the ending sounds looked identical’* or, as mentioned by another, *‘I wrote all words with [ice] because the ending sounds are identical’*.

5 – Justifications based on other reasons

Finally, other reasons such as *‘intuition’*, *‘having no idea’* or *‘there is no logical rule’* were stated.

‘Intuition’ may be a term representing some kind of implicit knowledge. One does not know why a spelling was used but has an impression that that is the accurate choice. In order to verify whether this knowledge could lead to discrimination of pseudo-words, the scores of each one of the seven teachers that mentioned ‘intuition’ as their main strategy were analysed. Only one had a positive, although low, discrimination of ‘-esa’ / ‘-eza’ pseudo-words and four discriminated ‘-ice’ / ‘-isse’ suffixes positively. None reached systematic assignment. Thus, intuition, on its own, was not very productive to spell pseudo-words.

8.5.3.2 – Spelling justifications by student-teachers

Student teachers were directly asked why are words that end in the same sound cluster /eza/ or /is/ spelled in two different ways. They were further inquired on how these distinctions could be learned or taught to children.

These student-teachers had spelled both pseudo-words and words, therefore it was expected that they would base their justifications in word knowledge.

The same types of justifications were identified except for the use of analogy that is unnecessary when one is already spelling words.

1 – Justifications in which some knowledge of morphology is involved.

In this first example, the student-teacher assembled information about the stimuli that was close to an accurate formulation of the morphological rules. It is stated that *‘[esa] is for nationalities and [eza] is for feelings... [isse] goes with verbs in the past and [ice] goes with names (of misbehaviours)’*.

All this information is true although incomplete. The suffix ‘-esa’ indicates origin and provenance in a wider way than just nationalities, such as social origin (e.g., ‘camponesa’, a rural worker). The suffix ‘-eza’ is certainly used with feelings (e.g., ‘tristeza’, sadness) but also with other abstract nouns that do not indicate feelings (e.g., ‘riqueza’, wealth). The suffix ‘-isse’ is for the past subjunctive but not for all tenses in the past and ‘-ice’ appears in names indicating some form of misbehaving (such as ‘parvoíce’, foolishness) but also in other abstract nouns such as ‘velhice’ (being elder). Thus, a lot of relevant information that has not yet reached the status of a coherent rule.

Despite that, this teacher discriminated all suffix pairs in words and pseudo-words systematically. As to how these spelling distinctions can be taught to children, this teacher referred that *'despite the fact that we have some rules and exceptions there are situations that we can teach to the children, for example how to write nationalities and verbs, because these are more common and more likely to be understood by children'*. Again, this approach is certainly helpful but its productivity would be increased if the rules did not leave relevant information out.

In a second example, the student-teacher also shows some knowledge but again a fragmented one. It is stated that *'as for [esa/eza] probably because the words ending in [s] for example 'Portugues' its feminine will take an a. The other words will take [eza]; As for [ice/isse], [isse] has to do with verbs, e.g., fugisse (if I ran away), whilst [ice] goes with nouns'*.

This teacher chose the right example 'Português'(Portuguese) to explain that these words take an 'a' in the feminine inflection. However, it is not because the word ends in 's'. Rather, it is because it ends in the derivational suffix '-ês' and '-esa' is its feminine form. There are also other words whose masculine form ends in 's' that are invariant in the feminine form (e.g., 'alferes', sub-lieutenant). As for the '-ice' / '-isse' suffixes, the justification points to much of the relevant information but lacks precision. Despite this fragmented formulation of a rule, this student-teacher spelled all words systematically. However, when spelling the pseudo-words, only one spelling pattern was used. This is an indication that the morphological status of the stimuli was not accurately accessed.

This teacher does not provide any justification on how to teach children.

A third example is from someone that can not find a rule for the suffixes ‘-esa’ / ‘-eza’ and has the same incomplete approach for the ‘-ice’/ ‘-isse’ suffixes. It is stated that *‘it is very hard to find an explanation for [esa/eza] ... I just learned to spell like that. As for [ice/isse], [ice] goes with nouns and [isse] with verbs’*. Accordingly, a systematic approach to spell ‘-esa’ / ‘-eza’ pseudo-words could not be found but systematic discrimination was achieved in the spelling of ‘-ice’ / ‘-isse’ words and pseudo-words. Teaching children will follow this incomplete knowledge of morphological rules: *‘I think that there are ways to teach these distinctions. In the case of [esa/eza] I do not know...maybe by systematic work on reading and spelling. In the second case, I think we can work out the distinction between nouns and verbs’*.

Similar approaches appear in other justifications: *‘I do not know about [esa/eza] and [ice/isse] ...maybe it has to do with verbs. Verbs go with [isse] and other words with [ice]’*. And another student-teacher: *‘as for [ice/isse], the words ending in [isse] are usually verbs, and those that end in [ice] are usually nouns (ex: ‘destruísse’ comes from ‘destruir (to destroy)’ / ‘velhice’ comes from ‘velho’ (elderly))’*.

Because a morphological rule is not formulated such that no cases are left out, this teacher thinks that *‘Children will find very hard to learn how to distinguish words with these endings. They will only succeed through a lot of work on reading and spelling. This is also related with the implicit grammar that we all have’*.

Another respondent corroborates this opinion: *‘There are no rules that we can teach to the children. They will only learn by practising on reading and spelling’*.

2 – Justifications involving wrong grammar considerations

Some student-teachers also produced justifications that were based on wrong grammar considerations. For example, someone wrote that distinguishing ‘-esa’ from ‘-eza’ *‘depends on the stem of the word...but it does not work with all words, for example, pobres - pobreza’ (poors – poverty)*. This example shows that the respondent does not know how to identify the stem appropriately because in the word ‘pobres’ one has the stem ‘pobre’ and the plural inflection ‘s’. Anyway, a rule relating the stems of ‘pobres’ and ‘pobreza’ (stems underlined) does not tell us anything about how to write the suffix.

3 – Justifications based on wrong phonological strategies

Similarly to what some more experienced teachers had mentioned, some student-teachers stressed that homophone suffixes can be distinguished by differences in sound.

One states that *‘I distinguish [esa/eza] words by intuition and by the sound that looks more appropriate; I distinguish [ice/isse] by the sound and because I know how they are spelled’*. Accordingly, this student-teacher adds that *‘I think that there should be ways to teach these distinctions (to children) but, sincerely, I’m not aware of them’*.

Another example of a yet more sophisticated attempt to explain how sounding may be useful: *‘maybe that [isse] words end in a more prolonged sounding and those ending in [ice] end in a more conclusive sounding*. And two examples are added: *‘Ex: fugisse, velhice’* (he ran away, old age).

This is rather an impossible approach.

4 – Justifications based on other reasons

Other reasons such as *'intuition'*, *'instinct'*, *'there are no rules'* are also presented and many of these respondents stress that the only way children can learn is by systematic spelling exercises and reading experience.

Because *'intuition'* is mentioned in a context where lexical information was available, an analysis of whether a high level of discrimination would appear was conducted.

Three student-teachers discriminated suffixes in words systematically. There was only one case that had discriminated all *'-ice'* / *'-isse'* pseudo-words systematically. The remaining used just one spelling to spell pseudo-words.

Thus, although intuition is probably a way to refer to knowledge that can not be explicitly formulated, that strategy might work reasonably well when spelling words but rather badly when spelling pseudo-words. It is possible, thus, that what is referred to as intuition is, ultimately, lexical knowledge.

8.5.4 – Summary of results

8.5.4.1. – Consistency in the spelling of stems and discrimination of homophone suffixes

1 – Consistency in the spelling of stems improves significantly and continuously with grade and complete consistency is reached in grade nine.

2 – There is a significant overall improvement with level of instruction of discrimination in the spelling of homophone suffixes, words and pseudo-words.

However, there are differences in the degree of systematic assignment reached across suffixes and word type.

2.1 – Children up to grade nine do not reach systematic assignment in the spelling of suffixes in either words or pseudo-words.

2.2 – Children in grade seven appear to reach a plateau in discrimination of homophone suffixes (words). The mean scores do not improve significantly towards grade nine.

2.3 – Student-teachers reach systematic assignment of ‘-ice’ / ‘-isse’ words. Discrimination of ‘-esa’ / ‘-eza’ words was not systematically achieved.

2.4 – Neither of the two groups of teachers reached systematic assignment when spelling suffixes in pseudo-words.

8.5.4.2 – Phases of spelling in homophone suffixes

1 – Children in grades five, seven and nine spelled ‘-esa’ / ‘-eza’ words unsystematically, more frequently than systematically (only 20 to 30 % of the spellings were systematic). Student-teachers were systematically correct approximately 65 % of the times.

2 – There is no apparent transfer from lexical knowledge to the spelling of ‘-esa’ / ‘-eza’ pseudo-words. Systematic assignments disappeared and both groups of teachers and children used spellings that conformed to the impossibility of identifying systematically the grammar category of the pseudo-word.

3 – Approximately 70 % of the spellings in ‘-ice’ / ‘-isse’ words are unsystematically assigned by children in grade nine. Only student-teachers spell these words systematically.

4 – Systematic assignment in ‘-ice’ / ‘-isse’ pseudo-words decreased dramatically even in student-teachers. The two groups of teachers and children make spelling choices that are mostly unsystematic or return to the use of just one spelling for both suffixes.

8.5.4.3 – Qualitative results: teachers’ justifications in the spelling of suffixes

1 – Systematic assignment of words is achievable by different strategies such as knowledge of morphology, spelling knowledge and by what some teachers referred to as intuition. However, when awareness (even if partial) of morphological rules existed systematic spelling of words and pseudo-words was more likely. Intuition alone was not effective to spell pseudo-words.

2 – The access to a clearer morphological distinction between nouns and verbs, by teachers, appears linked to systematic discrimination of ‘-ice’ / ‘-isse’ words. The fact that a no clear distinction is available for ‘-esa’ / ‘-eza’ words, where both grammar categories are nouns, is possibly linked to an increase in lack of discrimination in the latter suffixes.

8.6 – DISCUSSION AND CONCLUSIONS

This study showed that consistency in the spelling stems is achieved by children in grade nine. It also showed that, discrimination in the spelling of homophone suffixes

was extremely complex. Neither children at the end of grade nine nor student-teachers, after sixteen years of instruction, could discriminate the spelling of words ending in the suffixes ‘-esa’/ ‘-eza’, systematically. Children at the end of grade nine could not discriminate ‘-ice’ / ‘-isse’ words but student-teachers could. Knowledge in the spelling of words appeared not transferable to the spelling of pseudo-words, where low mean discrimination scores were obtained, even by experienced teachers.

When the longitudinal study was designed, the possibility of finding floor effects for systematic assignment of homophone suffixes could not be anticipated. A pilot study (not reported) had suggested that older children would find these distinctions hard. However, in accordance with some studies (Nunes et al, 1997 a; Bryant et al, 2000), a possibility was raised that some children would build up knowledge of morphological rules in the absence of explicit instruction. A longitudinal study would be a suitable method to examine the emergence of such knowledge, over time. Despite the progress that 6- to 9-year-olds made, this proved insufficient to achieve systematic discrimination. The present study, involving older children and adults, confirmed that systematic discrimination of homophone suffixes was far more a complex issue than could have been anticipated.

This discussion unfolds some of these complexities.

Studies in different languages have shown that when a sound can be spelled differently according to the morphology of the word, children tend to start using one spelling pattern that is the commonest phonological representation for such sound. For example Nunes et al. (1997, a) showed that younger children spell the past tense of regular verbs phonologically first (e.g. *loved* spelled as *lovd*). Read (1986) and Treiman (1993) also give examples of phonological spellings by younger children (e.g., *jumt* for *jumped*,

watid for *waited*). According to Nunes et al. (1997, a) morphological knowledge is slowly built upon awareness that phonology is not enough to represent the conventional spellings for morphemes.

Do Portuguese children do the same, i.e., do they take first the most appropriate phonological representation for a sound cluster and develop spelling discrimination based on morphology, later? The data in the studies suggest that Portuguese children might do it otherwise. In order to discuss such a possibility discrimination of each of the homophone suffix pairs is taken, in turn.

Discrimination of ‘-esa’ / ‘-eza’ suffixes

In the suffixes ‘-esa’ / ‘-eza’ the source of conflict is the representation of the middle sound /z/ that appears between vowels and that is represented by [s] in the former case and by [z] in the latter.

The most likely phonological representation of the middle sound /z/ is to use the letter [z]. This is what children are taught at the beginning of grade one when they are learning about sound-to-letter correspondences. However, there are many words where this sound can also be represented by [s] and children are taught quite early too, that there is also a spelling rule by which [s] between vowels also represents the sound /z/.

It is possible that as soon as they learn this contextual rule this becomes a tool for spelling that takes precedence over the most likely phonological representation for the sound /z/, the letter [z]. This is indeed what is suggested by the fact that one-pattern-users (Figure 8.3) chose [-esa], the non-phonological pattern, as their preferred pattern in grades two and three, as well as half of the children in grade four.

It is also possible that frequency effects play an important role in the establishment of a rule-like predominant approach. This is due to the fact, that [s], between vowels, is probably the most frequent representation of the sound /z/ in the language. There is no study making a systematic exam of the relative frequency of either [s] or [z], between vowels, to represent the sound /z/. The assumption that frequency effects may play an important role is based on counting of occurrences in the 'Corpus of Word Frequency' that was developed for the studies in this thesis. In this corpus, a ratio of 327 [s] words over 178 [z] words was found. When all the occurrences of these different words are added up, 2119 occurrences of [s] between vowels against 997 of [z] between vowels are found. This suggests that approximately twice as many different [s] words and [s] occurrences exist when compared to [z] words and [z] occurrences. Therefore, the effects of being taught a rule added to or reinforced by frequency effects may shape children's spelling choices i.e., children can not anchor their quest to learn morphological spellings on a first phonological matrix.

Although more frequent, the representation of [s] between vowels can not allow for 100 % accuracy. This is true in the language and is especially true in a spelling task where both contexts are balanced in number of items, independently of frequency ratios.

However, this rule - '[s] between vowels = /z/' - is so simple and appealing that one sees it still emerging in teachers' justifications of why they can not find a plausible explanation for why some words are written with '-esa' and others with 'eza'. Teachers know this rule, still seem to take it as universal, but soon realise that it only applies to the first suffix but not to the second.

To summarise, children are faced with a situation in which an initial phonological approach is devalued and soon replaced by contextual considerations that are taken as predictable but that only account for part of the spelling spectrum.

How can children move forward? The evidence presented in this study is quite uncomfortable: they can not. They improve their spellings of words up to grade seven, and progress is scarce thereafter. They use spelling rules that are not fully productive because they can not access a morphological rule that makes the spelling of these suffixes 100 % systematic. This rule is not taught in schools. A good reason for that was found in teachers' justifications. Teachers are not aware of it.

Nonetheless, one could expect that student-teachers would reach complete discrimination simply as a matter of increased spelling knowledge. That did not prove to be the case either. Their justifications suggested that many could not access a morphological rule explicitly, or when they could, its partial formulation left out relevant issues. This is, ultimately, responsible for the one quarter of spellings that remained unsystematic.

Because a clearly stated morphological rule is not accessed by most teachers, that explains why the profile of their answers is not that different from the older children's answers, when spelling pseudo-words. The spelling of pseudo-words is the clearest indication of the collapse of spelling strategies that do not include morphology. The positive contribution of reasoning by analogy is dependent on a correct identification of the grammar category of the pseudo-word and intuition is of limited effectiveness.

Finally, previous lexical knowledge brings again the issue of how the sound /z/ between vowels ought to be represented. Without a morphological rationale, 100 % predictability is impossible when spelling pseudo-words.

Discrimination of ‘-ice’ / ‘-isse’ suffixes

Despite the complexities involved in the spelling of ‘-esa’ / ‘-eza’ suffixes, the older children in this study were more accurate at discriminating them than ‘-ice’ / ‘-isse’ suffixes. This pattern, however, shifted when student-teachers’ spellings are examined. Student-teachers could discriminate the latter suffixes systematically. Teachers’ justifications provide a clear reason for that, the knowledge of a spelling rule that ‘[isse] goes with verbs and [ice] goes with nouns’. This incomplete rule allows for discrimination of these suffixes. This distinction may also become more salient because it goes across grammar categories (verbs in the subjunctive / abstract nouns) whilst in the former group of suffixes both ‘-esa’ and ‘-eza’ appear within the same grammar category (nouns / abstract nouns).

Children might not yet realised about this distinction and remain stranded within the different contextual representations for the sound /s/.

Children start by learning that the most likely phonological representation of the sound /s/ is the letter [s]. This is true of many words where /s/ is in absolute initial position (e.g. ‘sapato’, shoe). This is also true in middle position when /s/ is at the beginning of a syllable, preceded by a nasal vowel or a consonant (e.g., ‘salsa’, parsley). However, in these two contexts, 100 % predictability is impossible because other contextual rules may apply. For example in initial absolute position, the sound /s/ can also be spelled as [c] if followed by [e] or [i] as in ‘cesta’ (a basket). However, [s] is also possible in the latter context, as in ‘sesta’ (a nap). In middle position, when preceded by a consonant or a nasal vowel, similar contextual rules apply. The sound /s/ can be spelled by [s] or [ç] when followed by [a], [o] or [u] as in ‘dorço’ (torso) and ‘terço’ (one third) and by [s] or [c] when followed by [e] or [i] as in ‘concelho (local county) and ‘conselho’ (advice).

To what extent are children taught about these distinctions? They are taught that they should use [s] in initial position unless followed by [e] or [i], which does not account for the unpredictability of the words that can take either [s] or [c] in the latter condition.

They also learn that, in middle position, they must spell [ç] when followed by [a], [o] or [u] and [c] when followed by [e] or [i], which, again, does not account for all contexts that are unpredictable.

Children are also told that, in middle position and between vowels, the sound /s/ is represented by the digraph [ss]. This is true of many words such as ‘passo’ (a step) but again unpredictable as in ‘caça’ (hunting) or in ‘doce’ (sweet).

Children also learn that [s] is the most frequent marker for the plural inflection (e.g. ‘casas’ (houses) despite the fact that, in European Portuguese, the plural marker is never realised as the sound /s/. Rather it sounds as /ʃ/, /z/ or /z/ depending on whether or not a new word follows and on co-articulation with it (Mateus, 1996). The grapheme [s] is also spelled at the end of syllables, in middle position (e.g., ‘castelo’, castle) but again is never pronounced as the sound /s/ but always as /ʃ/ (Mateus, 1996).

If what children learn about the spelling of the sound /s/ is applied to the spelling of the suffixes children cannot make a decision. In both ‘-ice’ and ‘-isse’ suffixes the sound /s/ occurs between vowels, therefore should take the digraph [ss] but in both, too, the sound /s/ is followed by [e] therefore should take [c]. Only a morphological rule allows for 100 % predictability but this rule is not taught. Children would have to rely on spelling knowledge but, as this study showed, this is not enough even at the end of nine years of schooling. However, most student-teachers and some in-service teachers could infer a morphological rule (although sometimes incompletely) when explicitly asked for it.

Valuing teaching methods is not the focus here. The studies reported in this thesis were not designed to assess or compare the effectiveness of different teaching methods on morphological awareness and spelling development. Teachers have been using spelling approaches that are possibly based on professional knowledge and accumulated experience. Teaching spelling rules that refer to contexts that are more frequent in the language may be a good strategy. Children could not possibly be placed before the whole apparatus of complexities such as those exemplified here. Such an approach is explicitly proposed by Faraco (1994), a Brazilian linguist, that made an attempt to map the different sounds in the language, how predictable their different representations are and how those should be taught. Faraco claims that the representation [ss] is the most frequent representation in middle position and between vowels. Because of that, this representation should be taught first and other representations should be left for later stages. He goes on suggesting that in arbitrary representations such as when the sound unit /s/ appears between vowels (and this is the core issue in the spelling of words ending in homophone suffixes), *'it seems more accurate to work with the word as a whole unit'* (p. 31). The consequence of this is that teachers are advised to teach children to spell these words as individual lexical entries. Thus, a morphological rationale that allows for a complete predictability and productivity in the spelling of the suffixes is disregarded.

Research on the development of morphology in the spelling is in its initial stages and a comprehensive theory of spelling that explains how different morphological issues are developed is emerging but yet far from established. A new possibility that is raised by the present studies is that children follow different routes in different languages according to whether or not a morphological representation can be anchored in initial phonological strategies. Studies in the English (Nunes et al., 1997, a) and French (Fayol

et al., 1999) languages suggested that knowledge of spelling alternatives can first be built on phonology and then progress towards morphology. In the case of homophone suffixes in Portuguese, phonological representations of the suffixes are swiftly swept away from children's repertoire by frequency based contextual rules that they learn. Because these rules provide probabilistic but unpredictable spelling tools, children and adults rely on the extent of their lexical knowledge to sort ambiguity out. Many, never succeed.

Morphology, provides a productive answer for a part of the spelling spectrum, but researchers on development, linguistics or education have mostly neglected such approach.

Portuguese children and adults are not learning enough about the spelling issues studied here throughout the full range of their formal education. It is possible that much more cost-effective learning tools, based on morphology, can be developed. In order to test that, intervention studies are needed comparing the performance of children and adults taught systematically about the relations between morphology and spelling and those not taught.

Chapter 9

Conclusions and discussion

The aim of this chapter is to sum up the conclusions of the studies, discuss their main findings and limitations, and propose theoretical and educational implications.

Children's spelling can be influenced by morphological information, provided under the form of priming.

The first study investigated the spelling of phonologically changed stem vowels in derived words. A new research technique, priming the spelling with phonologically transparent stems of base forms, was used. This intended to create a learning context in which the kind of cognitive questions that children are faced with when spelling derived words – ‘where does this word come from?’ and – ‘how is the base form spelled?’ - were made available in the priming conditions, without children's explicit awareness.

The design of the study provided three types of control.

Firstly, one could evaluate whether there was any effect of morphological priming by comparing children's performance in a baseline, no-priming condition, and in two conditions of priming. If no effect of priming existed, then no differences should be found.

Secondly, it was possible to take advantage of an interesting linguistic feature of primes and targets. Their stems, although written in the same way, are phonologically dissimilar. Because of this, one can separate facilitation as simply due to a phonological artifact and concentrate on the effects of the morphological relation of the stimuli that is primed.

Thirdly, after controlling for a phonological artifact, it was also crucial to exclude that facilitation was simply a matter of semantic relation between the stimuli. This was

achieved by the use of pseudo-words. Because pseudo-words have no meaning, any facilitation observed would indicate that a specific effect of the prime was not determined by meaning relations.

Finally, the use of low-frequency derived-words and of pseudo-words provided control for lexical effects. When spelling derived words one can not be 100% sure that no previous lexical knowledge is involved. However, if only lexical knowledge explained performance in spelling, no difference should be found across priming and no-priming conditions. The use of low-frequency words enhances the possibility that lexical knowledge is not a major contributor. The use of pseudo-words provides a more rigorous control for lexical knowledge.

The study tested the hypothesis that *morphological priming with base forms that have stressed and clearly articulated stem vowels will influence the spelling of phonologically changed vowels in the stems of morphologically related derived words.*

This study provided evidence that there was a significant overall effect of morphological priming. Children in the priming conditions performed significantly better than those non-primed. This effect was specific, because it could not be explained by phonological, semantic or lexical influences.

These results supported the evidence found in morphological priming studies with adults that morphologically related primes activate the morphemic representation of the target word. By this effect children's spelling of phonologically changed vowels in the stem of derived forms is activated by the morphemic representation of the stem in the prime where that vowel is stressed, well articulated, and transparent. Despite differences in methodology (use of reaction times possible in lexical decision experiments with adults but unproductive in examining children's spelling), this study supports the main conclusion

that significant facilitation occurs when primes and targets are morphologically related (Murrell & Morton, 1974; Kempley & Morton, 1982; Emmorey, 1989; Foster & Azuma, 2000; Raveh & Rueckl, 2000; Laudanna, Badecker & Caramazza, 1989; Grainger, Colé & Segui, 1991).

Similarly, the finding that priming effects are not artefacts of phonological (Murrell & Morton, 1974; Emmorey, 1989), orthographic (Murrell & Morton, 1974; Foster & Azuma, 2000; Laudanna, Badecker & Caramazza, 1989; Grainger, Colé & Segui, 1991) or semantic (Emmorey, 1989) similarity with the targets was also supported.

However, morphological priming effects did not distribute evenly across all grade levels.

Oral primes, or oral plus written primes, were not significantly more effective than no-priming in enhancing morphological spellings, in grades one and two (6- and 7-year-olds). Spelling performance in words was significantly influenced by oral or oral plus written priming, in grades three and four. Spelling performance in pseudo-words was significantly influenced by oral plus written priming, in grade four.

This pattern of results suggests that the younger children show no signs of being influenced by the morphological relation between base and derived forms that is the object of priming. This goes against Treiman et al.'s (1994) finding that American children, as early as kindergarten and first grade, show some signs that they are able to incorporate morphological information from the stem in base forms when spelling /t/ and /d/ flaps in two-morpheme (derived) words. Rather, this study supports the view that a certain level of development is required before morphological information is accessed in the spelling. Nunes (1998), Aidinis (1998), Carlisle (1988) all suggested that the representation of morphology in consistency in the spelling of stems is not an early process. Nunes et al. (1997 a, b), Bryant et al. (1997), Fayol et al. (1999), studying spelling issues other than

stems, also suggested that children use phonological strategies before morphological strategies are introduced in the spelling, and that getting to a morphological phase is a long process. One should say, however, that none of the above studies mentioned here is a priming study. It is possible that morphological effects are sensitive to the methodological differences in the studies.

Thus, the present study provided confirmation for the hypothesis that the spelling of stems in derived forms can be influenced by morphological priming, at least in grades three and four. This priming effect is not an artifact of phonological, semantic or lexical similarities between primes and targets, but rather a genuine morphological effect.

This study also contributes evidence that a new method, morphological priming, is suitable to examine children's spelling processes. This method can be refined in order to control for the number of intervening items between prime and target, explore new ways to present the stimuli either visually or orally, and to devise more accurate forms of measurement.

This study establishes a sort of baseline. It answers the core question of whether morphological information is likely to be incorporated in children's spelling in Portuguese. The answer to this question is positive, at least for 8- and 9-year-old children.

This led to the test of an additional hypothesis, that of whether this process of incorporating morphology in the spelling could be explained by the development of a metalinguistic ability, morphological awareness.

Morphological awareness is (concurrently) related to consistency in the spelling of stems. Evidence on a relation with discrimination of homophone suffixes is mixed.

After showing that older children were sensitive to primed morphological information, whether such sensitiveness was based on morphological awareness was examined.

Two new spelling issues that require morphology, as in the classification proposed by Bryant et al. (1999), were analysed. The first was Consistency in the Spelling of Stems in Base and in Derived forms. Here, the spelling of stems (in the derived-forms) flouts letter-sound correspondence rules. Therefore, spelling the stems consistently in the base and in the derived forms requires awareness that the equivalence in the spelling of the stems is a mark of their morphological relation. The second was Discrimination in the Spelling of Homophone Suffixes in Words and Pseudo-words. Here, there is the same sound cluster for the two suffixes but differences in its spelling, according to grammatical status of the stimuli.

The study tested the hypothesis that *there is a predictive relation between morphological awareness and accuracy in morphologically based spellings which cannot be explained by the fact that the two relate to a third factor.*

In order to test this hypothesis, it was necessary to overcome a major constraint, that of not having adequate measures of morphological awareness in the Portuguese language.

The results of Session A of the longitudinal study were analysed so that a cross-sectional assessment of the reliability of the morphological awareness measures could be obtained.

A similar aim was to assess reliability of the new spelling measures.

It was found that the measures of morphological awareness (Word Analogy and Sentence Analogy) were reliable and strongly interrelated even after controlling for Grade and IQ differences. The spelling measures were also found to be highly reliable.

As grade increased, children improved their level of morphological awareness as well as their accuracy in the spelling.

Then, the core issue was to examine whether morphological awareness and spelling were interrelated.

The results of the multiple regressions showed that both the Word Analogy and the Sentence Analogy tasks contributed with unique variance to Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli, over and beyond the variance accounted for by Grade and IQ. However, no independent contribution was found from the morphological awareness measures to Consistency in the Spelling of Stems in Base – Derived words.

This apparent contradiction was interpreted as an effect of a greater salience of the stems in the pseudo-derived stimuli. Children would find it easier to access and parse the morphological structure of a pseudo-derived stimulus because real, meaningful, morphemes (a stem and a suffix) are aggregated in a combination that does not exist in the language. Because of this unexpected formation, the meaning for the most determining morpheme – the stem – becomes salient. Accessing the meaning of the stem in a real derived word is not as necessary, because the child can readily access the meaning of the whole word. However, the likelihood of this interpretation requires empirical confirmation.

This trend of findings is in line with previous cross-linguistic research about Consistency in the Spelling of Stems (Carlisle, 1988; Nunes, 1998; Aidinis, 1998) despite the fact that different approaches to assess morphological awareness were used, in particular by Carlisle.

The present study also confirmed that morphological awareness (as measured by the Sentence Analogy task) played a unique role in the amount of discrimination that children achieved in the spelling of words ending in the homophone suffixes ‘-esa’/ ‘-eza’. This role was confirmed despite a stringent control for differences explained by third factors, namely Grade and IQ. However, Sentence Analogy just failed to contribute with unique variance to the spelling of words ending in ‘-ice’/ ‘-isse’. Additionally, no significant contribution was identified for the spelling of homophone suffixes in pseudo-words.

No previous study to my knowledge, other than Da Mota’ s (1995), examined the relation between morphological awareness and discrimination of homophone suffixes in Portuguese. Despite, or because of, methodological insufficiencies (a very small number of stimuli and not using a discrimination score) she could not identify a clear relation.

Thus, this study extends the present knowledge about the contribution of morphological awareness to the spelling of homophone suffixes in Portuguese. This calls for the need to conduct more research. One such area of research might be to devise and test a range of even more comprehensive measures to examine morphological awareness.

This study also contributes new methodological tools to assess discrimination of homophone suffixes. As shown in Chapter 4, it is misleading to examine accuracy in the spelling of each one of the suffixes in the pair separately. If a child is 100% right in ‘-esa’ and 100% wrong in ‘-eza’, this only indicates that discrimination is at its minimum. Da Mota’ s (1995) study did not consider this. However, the statistical approach that was undertaken, based on Guilford’s (1954) correction for chance formula, cannot respond satisfactorily to all the researcher’s questions. As an example, the Guilford’s formula does not differentiate satisfactorily between a child that spelled ‘-esa’ correctly 8 times and ‘-eza’ incorrectly 8 times from another child that spelled ‘-esa’ correctly 4 (out of 8) times and ‘-eza’ correctly 4 (out of 8) times. In either case the discrimination score is 0 (zero)

because both children had 8 spellings correct and 8 incorrect. However, a more accurate interpretation of such data is that the first child indiscriminately uses one spelling pattern for the two homophone suffixes and the second is already taking some notice that more than one pattern of spelling is required.

Thus, one needs to continue to develop comprehensive ways to assess morphological awareness and spelling discrimination.

After providing at least a partial confirmation that morphological awareness plays a role in the improvement of morphologically based spellings, the search moved on to further examine this relation longitudinally. Using cross-sectional and longitudinal designs allows an even stronger basis to analyse whether relations could be causal.

There is a predictive relation between morphological awareness and consistency in the spelling of stems, which can not be explained by the fact that the two relate to a third factor.

The findings of the previous concurrent analyses led to the conclusion that morphological awareness was, to some extent, involved in the improvement of morphologically based spellings. The aim of the following study was to examine this relation in detail, using a longitudinal method. Now the focus was to examine whether morphological awareness, measured earlier in the study, was able to predict the degree of improvement in the spelling some time later.

The study tested the hypothesis that *there is a predictive relation between morphological awareness and consistency in the spelling of stems.*

A very strong confirmation of this hypothesis was found. Morphological awareness measures taken six or twelve months earlier, strongly predicted the outcome measures of Consistency in the Spelling of Stems over and beyond the contributions of Grade and IQ.

Besides the use of the Word Analogy and the Sentence Analogy tasks, a third measure of morphological awareness was introduced in Session B, the Pseudo-word Interpretation task. These three tasks provided a more comprehensive assessment of morphological knowledge required in the spelling of Portuguese.

Throughout the study children progressed significantly in their ability to use awareness of morphology and to spell stems consistently.

Two measures of morphological awareness in Session B, the Sentence Analogy and the Pseudo-word Interpretation, predicted the level of Consistency in the Spelling of Stems in Base – Derived-words and in Base – Pseudo-derived stimuli, in Session C, after the variance explained by Grade and IQ had been accounted for. Most interestingly, the Word Analogy and the Sentence Analogy, measured at the beginning of the study, already predicted the level of Consistency in the Spelling of Stems in Base – Pseudo-derived stimuli twelve months later, after controlling for Grade and IQ differences.

Thus, the hypothesis that morphological awareness is necessary to explain consistency in the spelling of stems received a strong confirmation over a period of six months and a very encouraging confirmation over the 12 months of the study, at least for Base – Pseudo-derived stimuli. As suggested in the concurrent analysis, it is possible that the latter stimuli render the stem more salient. Therefore, this longitudinal prediction may indicate that children identify the morphemic structure of a derived word and, in doing so, access the morphological relation of the stems of the base and the derived stimuli more readily.

One has then, both concurrent and longitudinal analyses confirming a relation between morphological awareness and the ability to spell stems consistently. These findings strongly suggest that morphological awareness is a building block in the development of consistency in the spelling of stems.

Children progress through a sequence of phases of spelling without achieving systematic assignment of ‘-esa’/ ‘-eza’ homophone suffixes

This thesis moves on to examine the longitudinal predictions between morphological awareness and the level of discrimination in the spelling of words and pseudo-words ending in the homophone suffixes ‘-esa’/ ‘-eza’.

The concurrent analysis, reported in Chapter four, had provided evidence confirming a relation between morphological awareness and discrimination of these suffixes, at least in the spelling of words.

It was argued that one needs to consider the profile of the spelling phases, together with a quantification of the number of suffixes that are accurately spelled.

The analysis of spelling phases attempted to test a model (Nunes et al., 1997a), that was developed through a large scale longitudinal study. This model proposes that children move from phonological to morphological spelling strategies in the spelling of morphemes that have conventional spellings (such as the ‘-ed’ morpheme at the end of past-tense regular verbs in English). This model showed to be comprehensive enough to explain the development of the spelling of different morphemes in other languages, such as Greek (Aidinis, 1998) and French (Fayol et al., 1999). Both the Greek and French evidence was cross-sectional. The study in this thesis is, to my knowledge, the first attempt to evaluate this model longitudinally, and in the Portuguese language.

This study tested the hypothesis that *correct assignment of '-esa' / '-eza' homophone suffixes, in words and pseudo-words, follows a series of spelling phases: use of one spelling pattern for the two suffixes; then use of more than one pattern without systematic assignment and, eventually, systematic assignment.*

In order to test the hypothesis that there is a sequence of spelling phases it was necessary to develop a set of criteria. These criteria attempt to answer many questions, such as: What is the minimum number of phonologically acceptable spellings that is necessary as a baseline entry to the model of spelling phases? How many occurrences of an alternative spelling is a clear indication that the child has not started yet (or has already started) to figure out that more than one pattern is needed to discriminate the spelling of homophone suffixes? Is it the same to use two spelling patterns unsystematically but mostly on the right positions, or to use them mostly on the wrong contexts? Where do we draw a line separating unsystematic from systematic assignment?

All criteria involve decisions from the researcher that shape the way the data are analysed and some of those decisions may represent the data fairer than others. Similarly to the developmental criteria used in Nunes et al. (1997 a) it was attempted to set up demanding but balanced parameters. All the criteria used are detailed in chapter 6.

This analysis provided evidence that belonging to spelling phases was significantly and positively correlated with children's age. This confirmed that the spelling phases were developmentally shaped, i.e., the younger the children, the lower the spelling phase and the older the children, the higher the spelling phase. It was also found that the majority of the children stayed in the same phase or progressed one or more phases, throughout the twelve months of the study. There were however, two weaknesses in the model. The first consisted of the occurrence of 12 % of children that, at the end of the study, had regressed to a spelling phase lower than the one assessed twelve months earlier. The second

weakness was related to the very small number of children that achieved the last spelling phase, the systematic assignment of the homophone suffixes.

The study does not provide an answer as to why 12 % of the children regressed to a lower spelling phase (in the spelling of words). This percentage, however, is equivalent to what was found in Nunes et al's, (1997 a) longitudinal study. There, 12.3 % of the children were backsliders when comparing their relative positions in Sessions A and B, separated by seven months. Similarly, 11.5 % of the children were also backsliders when comparing Sessions B and C, separated by 13 months, a time length similar to that used in the present study.

This analysis also revealed that only a very small number of children reached systematic assignment of the suffixes (in the spelling of words). This indicates that the test of the model could not be fully achieved in this study.

There is a predictive relation between morphological awareness and discrimination of '-esa' / '-eza' homophone suffixes, which can not be explained by the fact that the two relate to a third factor.

The hypothesis that *there is a predictive relation between morphological awareness and discrimination of the homophone suffixes '-esa' / '-eza', which can not be explained by individual differences in level of instruction or general intelligence* was tested.

The results of the multiple regressions confirmed that it was possible to predict the level of discrimination in the spelling of the suffixes by measures of morphological awareness assessed six months before the spelling measures. In effect, the Sentence Analogy and the Pseudo-word Interpretation tasks in Session B, predicted Discrimination of '-esa' / '-eza' Words in Session C. The Pseudo-word Interpretation task in Session B, also predicted Discrimination of '-esa' / '-eza' Pseudo-words in Session C. These results are unique

contributions of the morphological awareness measures to the outcome variable, after controlling for the variance explained by Grade and IQ.

No predictions were found from assessments of morphological awareness in Session A, when compared to discrimination in Sessions B or C.

Thus, one has a partial confirmation of the hypothesis that there is a predictive relation between morphological awareness and discrimination of '-esa' / '-eza' homophone suffixes.

Children progress through a sequence of phases of spelling without achieving systematic assignment of '-ice' / '-isse' homophone suffixes

An identical methodological approach was used to analyse spelling phases used by children to discriminate the spelling of '-ice' / '-isse' homophone suffixes and the relation between morphological awareness and discrimination.

The hypothesis was that *correct assignment of '-ice' / '-isse' homophone suffixes, in words and pseudo-words, follows a series of spelling phases: use of one spelling pattern for the two suffixes; then use of more than one pattern without systematic assignment and, eventually, systematic assignment.*

It was also found that phases of spelling and age correlated positively and significantly.

The younger children also tended to use just one spelling pattern for the two suffixes.

Then, the majority of the children introduced alternative patterns to their spelling but assigned them unsystematically to right and wrong contexts. A surprisingly low number of children reached systematic assignment (in the spelling of words). The percentage of spellings where children regressed in the spelling phases was 10.3 % in the spelling of words and 12 % in pseudo-words, which is also within the proportions found in Nunes et

al. (1997 a). The floor effects that were found for systematic assignment were to some extent unexpected.

There is a predictive relation between morphological awareness and discrimination of '-ice' / '-isse' homophone suffixes, which can not be explained by the fact that the two relate to a third factor.

The hypothesis that *there is a predictive relation between morphological awareness and discrimination of the homophone suffixes '-ice' / '-isse', which could not be explained by individual differences in level of instruction or general intelligence*, was tested.

A homogeneous pattern of significant predictions was found. Sentence Analogy in Session A predicted Discrimination of '-ice' / '-isse' Words and Pseudo-words six months later. Sentence Analogy and the Pseudo-word Interpretation task in Session B, successfully predicted Discrimination of '-ice' / '-isse' Words and Pseudo-words, in Session C. Again, the Sentence Analogy task, in Session A predicted children's Discrimination of '-ice' / '-isse' Words twelve months later. These predictions refer to unique variance explained by the morphological awareness measures, after controlling for Grade and IQ.

Thus, if we interpret systematic assignment as the only indicator that a morphological strategy is being used in the spelling, there is little ground to suggest that such strategy is used. However, if one takes discrimination as a continuous quantitative measure that improves slowly as children progress in schooling experience, one finds a significant and specific contribution of morphological awareness in such improvement.

Systematic consistency in the spelling of stems and discrimination in the spelling of homophone suffixes is only reached by older children and adults.

The longitudinal study left unanswered the questions of when consistency in the spelling of stems and discrimination of homophone suffixes were, eventually, systematic. The last study attempted to answer those questions.

Children in grades 5, 7 and 9 were asked to spell the same stimuli as in the longitudinal study. Preliminary analysis indicated that Consistency in the spelling of Stems was eventually achieved. However, discrimination in the spelling of homophone suffixes appeared difficult even for the older children (Grade 9, 14-year-olds). This led to the hypothesis that the older children had never understood the grammatical rationale underlying discrimination of homophone suffixes and raised the question of whether teachers knew it.

The aim of including teachers was twofold. Firstly, to examine whether systematic discrimination was eventually achieved by teachers. Secondly, to question teachers about their justifications for spelling choices. This would provide valuable qualitative information on how discrimination was attempted, and would indirectly suggest whether the morphological rationale underlying discrimination was taught.

The results showed that Consistency in the Spelling of Stems (Base – Derived and Base – Pseudo-derived Stimuli) was only at ceiling by Grade 9, although there was a steady progress from grades five to nine.

This provides first evidence in Portuguese that representing in the spelling what morphologically related words have in common (their stems), is a long process. This finding is in line with those of Carlisle (1988), Nunes et al. (1997 a), Bryant et al. (1997)

showing that morphemes are a complex issue in the spelling and that their level of complexity determines a later acquisition.

The results for Discrimination of '-esa'/'-eza' homophone suffixes were quite surprising. Even student-teachers did not achieve systematic discrimination at the end of 16 years of instruction, despite the fact that they were spelling words. Added to this, a dramatic drop in discrimination in the spelling of Pseudo-words was found. There, even experienced teachers reached a very low positive discrimination score.

The results for Discrimination of '-ice'/'-isse' suffixes were slightly more encouraging. Children in Grade 9 did not reach systematic discrimination but student-teachers did. This discrimination was systematic only in the spelling of Words. Even experienced teachers did not achieve systematic discrimination in the spelling of Pseudo-words.

Teachers were asked for spelling justifications under two conditions. Some teachers simply spelled pseudo-words. This allowed the separation of morphological knowledge from lexical knowledge. Others were asked after spelling words and pseudo-words, allowing them access to lexical knowledge.

The analysis of the justifications showed that morphological knowledge was more easily accessed in '-ice'/'-isse' than in '-esa'/'-eza'. This had to do with an easier distinction between nouns and verbs in the former suffixes. However, the enunciation of a morphological rule was usually incomplete. Frequently, inaccurate strategies were called upon such as the use of analogy into wrong grammatical categories or the use of phonological strategies. As a rule, the enunciation of a morphological principle, after spelling pseudo-words only, was mostly inaccurate. Achieving systematic discrimination in the spelling of words could not be dissociated from lexical information.

As a rule, it could be concluded that teachers' level of explicit awareness about the morphological rules that provide 100 % accuracy in discrimination of homophone suffixes was rather weak.

The spelling of homophone suffixes is harder because children, and adults, can not anchor their learning on a first phonological matrix.

In the discussion of the previous study, it was proposed that a new theoretical approach should be researched. Evidence suggesting that children can build up morphological rules in the absence of explicit instruction (Bryant, et al., 2000; Nunes et al., 1997, b) cannot explain the lack of morphological understanding that was found after 16 years of instruction. This evidence was based on how English children master the conventional spelling of one morpheme, the '-ed' morpheme in past regular verbs. It is possible that the level of complexity necessary to discriminate the two pairs of homophone suffixes in Portuguese poses new demands on the spellers. On the other hand, Bryant, et al.(2000) and Nunes et al. (1997, b) showed quite clearly that English children work out the problems of homophony in the endings of regular and irregular verbs in the past (for example 'kissed' and 'lost' end in the same /t/ sound) by concentrating first on a phonological basis. After a phonological stage children develop a progressive differentiation towards morphological strategies. This differentiation starts with unsystematic assignment of phonological and morphological spelling patterns, goes through periods of generalisation of a morphological pattern ('-ed') to non-verbs and irregular verbs, before getting to a differentiation of the only context where the morpheme '-ed' can be used, i.e., regular verbs. In English, children notice that, quite frequently, the ending sound /t/ is spelled phonologically. Examples of this are irregular verbs such as 'felt', 'left', 'lost' and words such as 'belt', 'next' or 'soft'. What they have to learn is that some verbs have this /t/ ending sound spelled morphologically as '-ed', as in 'dressed' or 'stopped' (all examples are from Nunes

et al., 1997 a). This learning goes hand in hand with the gradual understanding that there is a morphological rule characteristic of regular verbs, to share the same stem in the present and in the past. Thus, in English, the phonological pattern is a clear base from which differentiation towards a morphological pattern can be built upon.

It was argued that Portuguese children cannot first anchor their understanding of the suffixes on a clear phonological matrix.

In the suffixes ‘-esa’/ ‘-eza’ the phonological representation for the middle /z/ sound is [z] but this is not the most frequent representation for that sound in this language. The alternative [s] is more frequent and reinforced by contextual rules that are inaccurately taught as if they accommodate the whole spelling spectrum. Moreover, in contexts other than these homophone suffixes, the representation for the middle sound /z/ when between vowels, can take either [s] or [z], i.e., is unpredictable.

In the suffixes ‘-ice’/ ‘-isse’ the problem is even harder. The most likely phonological representation for the middle sound /s/ is [s]. To begin with [s] is not contextually acceptable in any of the suffixes, as [s] between vowels would sound /z/. Moreover, when we go over the range of situations where this sound occurs, it becomes clear that one can have [s] or [ç] or [c] or [ss] and that these representations are not 100 % predictable (the only exception is that [ç] cannot be used to begin a word or before [e] or [i]). Additionally, the representations by [c] and [ss] occurring in the suffixes are both justifiable by contextual rules: [c] can be used before [e] and [ss] can be used between vowels. However, these contextual rules apply in any of the two suffixes, therefore adding to ambiguity.

Morphological rules, the only productive tool to untangle these complexities, are not known by teachers and taught to students, are not recognised by linguists (Faraco, 1994), and have scarcely been researched.

In conclusion, in Portuguese there is not a clear phonological matrix that secures a significant proportion of the spelling options of homophone suffixes. As a consequence, children, and surprisingly, adults, have to manage spelling information based on an entangled puzzle of contextual rules, taken as productive, but that only account for some contexts.

Thus, in terms of a theory of the development of morphology in the spelling, it might be necessary to separate situations where children can work out spelling strategies anchored on a phonological matrix from those where a high level of unpredictability has to be dealt with from the very start.

In the case of Portuguese, the use of just one spelling pattern signifies that the child elected one form of representation as the most likely phonological representation for a sound. This form can be the most likely phonological representation for a sound, or already be influenced by contextual information that the child received. It is possible that some children start to incorporate more than one spelling pattern quite soon because they attempt to make sense of the many contextual representations of a sound. The floor effects found for systematic discrimination reflect the need to consider a previous, long phase, dedicated to the management of important contextual rules that can not assure full predictability.

Limitations and suggestions for future research

The studies provide both cross-sectional and longitudinal evidence on the relation between morphological awareness and spelling. However, establishing firm causal relations between the two requires additional research, longer longitudinal studies and intervention studies.

The studies must also be complemented with case studies. These would allow the examination as to why some children reached consistency in the spelling of stems or systematic assignment of suffixes earlier than others. Developing adequate ways of asking children for their spelling justifications is also needed to highlight what cognitive strategies they use.

There are many other instances in spelling in Portuguese where similar problems of phonological changes in the stems or of homophony in suffixes can only be sorted out by morphology. It is necessary to enlarge the research base and integrate efforts from different linguistic, developmental and educational disciplines.

Theoretical and educational implications

The studies in this thesis add new evidence for the relation between morphological awareness and spelling. Children are sensitive to morphological information. They can transfer recognition of morphological relations into new situations and develop this ability throughout schooling. Their ability to deal with morphological relations in the spelling of base morphemes also improves steadily. This suggests that a stronger morphological rationale should be developed in educational contexts. Children develop abilities that are, to some extent, underestimated. Schools and teachers can take this evidence as support for the need to make the learning of spelling more productive. Morphology can provide children with tools that apply, productively, to categories of words, instead of learning each word as a separate lexical entry.

In the case of the discrimination of homophone suffixes, the level of internal complexity is very high and present theoretical models cannot entirely account for it. The effectiveness of actual educational practices also appears limited. This suggests that developments are

needed both on a theoretical and educational level. One needs further evidence to decide whether, if at all, it is expectable that most children can overcome these complexities. There is also the need for intervention studies that compare learning after direct instruction on the morphological rules with learning based on usual educational practice.

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Appendix 3.1: The spelling task in the morphological priming study

Spelling Condition 1: (No Priming; Pseudo-words)

1. Ele está a tocar pandeireta; ele está a candorilar. Candorilar
2. Uso uma tábua para barfelar. Barfelar
3. São horas da folia; vamos todos badear. Badear
4. Um adivinho é alguém que sabe trovetizar. Trovetizar
5. Tu és um grande malandro; só fazes ranotices. Ranotices
6. Repartir com os outros não é ser manfejoso. Manfejoso
7. Que bom cheirinho; este café é mesmo biromático. Biromático
8. Os pássaros saltam; estão a chulbear no telhado. Chulbear
9. O teu amigo é um grande atrevido ; anda sempre a bacriolar. Bacriolar
10. A minha terra chama-se Golneal. Golneal
11. O lápis é vendido na bramelaria. Bramelaria
12. Fiz uma boa compra; não há melhor gabociante do que eu. Gabociante
13. Eu gosto de gelado; estou a bafurear o gelado. Bafurear
14. Afastei a aranha com uma binelada. Binelada
15. Eu estou a namutear o martelo. Namutear
16. Se precisar de mim estou à sua pistoriço. Pistoriço
17. Eu trato do cabelo; estou a banzear o cabelo. Banzear
18. Estás sempre na brincadeira; isso é que é abogar! Abogar
19. A pata do meu gato é muito benuda. Benuda
20. Aqui não há nada a rewear. Rewear
21. Ele ganhou o concurso da maior barba; que grande gabodaça que ele também tinha.
Gabodaça

22. Disse bom-dia, hoje de manhã, ao gaudeleiro. Gaudeleiro

23. A aranha começou a fazer um tabear. Tabear

24. A colcha da minha cama está por cima do ropertor. Ropertor

Spelling Condition 2 and 3: (Oral or Oral plus Written Priming; Pseudo-words)

1. Ele está a fazer candor; está a candorilar. Candorilar

2. Uso o barfelo para barfelar. Barfelar

3. São horas da badeia; vamos todos badear. Badear

4. Um troveta é alguém que sabe trovetizar. Trovetizar

5. És um grande ranoto; só fazes ranotices. Ranotices

6. Ter manféja é o mesmo que ser manfejoso. Manfejoso

7. Que bom biroma; este café é mesmo biromático. Biromático

8. Os pássaros chulbeiam; estão a chulbear no telhado. Chulbear

9. O teu amigo é um grande bacriola; anda sempre a bacriolar. Bacriolar

10. Na minha terra há muitas golneias; por isso se chama Golneal. Golneal

11. O bramel é vendido na bramelaria. Bramelaria

12. Fiz um bom gabócio; não há melhor gabociante do que eu. Gabociante

13. Eu bafureio o gelado; estou a bafurear o gelado. Bafurear

14. Afastei a aranha com o binelo; levou uma binelada. Binelada

15. Eu namuteio o martelo; estou a namutear o martelo. Namutear

16. Estou ao pistor; estou à sua pistorição. Pistorição

17. Eu banzeio o cabelo; estou a banzear o cabelo. Banzear

18. Estás sempre no abogo; isso é que é abogar! Abogar

19. A bene do meu gato é muito benuda. Benuda

20. Não tenhas reveio do cão; não há nada a revear. Revear

21. Ele ganhou o concurso do maior gabode; que grande gabodaça que ele tinha. Gabodaça
22. Comprei uma gaudela, hoje de manhã, ao gaudeleiro. Gaudeleiro
23. A aranha fez uma tabeia ; parece mesmo um tabear. Tabear
24. A roperta da minha cama está por cima do ropertor. Ropertor

Spelling Condition 4: (No Priming; Words)

1. Ele está a tocar pandeireta; ele está a tamborilar. Tamborilar
2. Uso uma tábua para martelar. Martelar
3. São horas de comer; vamos todos cear. Cear
4. Um adivinho é alguém que sabe profetizar o futuro. Profetizar
5. Tu és um grande malandro; só fazes marotices. Marotices
6. Repartir com os outros não é ser invejoso. Invejoso
7. Que bom cheirinho; este café é mesmo aromático. Aromático
8. Os pássaros saltam; estão a chilrear no telhado. Chilrear
9. O teu amigo é um grande atrevido ; anda sempre a cabriolar. Cabriolar
10. A minha terra chama-se Baleal. Baleal
11. O lápis é comprado na papelaria. Papelaria
12. Fiz uma boa venda; não há melhor negociante do que eu. Negociante
13. Eu gosto de gelado; estou a saborear o gelado. Saborear
14. Afastei a aranha com uma chinelada. Chinelada
15. Eu estou a manusear o martelo. Manusear
16. Se precisar de mim estou à sua disposição. Disposição
17. Eu trato do cabelo; estou a pentear o cabelo. Pentear
18. Estás sempre na brincadeira; isso é que é gozar! Gozar
19. A pata do meu gato é muito peluda. Peluda

20. Não tenhas medo do cão; não há nada a recear. Recear
21. Ele ganhou o concurso da maior barba; que grande bigodaça que ele também tinha.
Bigodaça
22. Disse bom-dia, hoje de manhã, ao cauteleiro. Cauteleiro
23. A aranha estendeu os seus fios; já parece mesmo um tear. Tear
24. A colcha da minha cama está por cima do cobertor. Cobertor

Spelling Condition 5 and 6: (Oral or Oral plus Written Priming; Words)

1. Ele está a tocar tambor; ele está a tamborilar Tamborilar
2. Uso o martelo para martelar. Martelar
3. São horas da ceia; vamos todos cear. Cear
4. Um profeta é alguém que sabe profetizar o futuro. Profetizar
5. Tu és um grande maroto; só fazes marotices. Marotices
6. Ter inveja é o mesmo que ser invejoso. Invejoso
7. Que bom aroma! Este café é mesmo aromático. Aromático
8. Os pássaros chilreiam; estão a chilrear no telhado. Chilrear
9. O teu amigo é um grande cabriola; anda sempre a cabriolar. Cabriolar
10. Nesta terra caçavam-se baleias; por isso se chama Baleal. Baleal
11. O papel é comprado na papelaria. Papelaria
12. Fiz um bom negócio; não há melhor negociante do que eu. Negociante
13. Eu saboreio o gelado; estou a saborear o gelado. Saborear
14. Afastei a aranha com o chinelo; levou uma chinelada. Chinelada
15. Eu manuseio o martelo; estou a manusear o martelo. Manusear
16. Estou ao seu dispor; estou à sua disposição. Disposição
17. Eu penteio o cabelo; estou a pentear o cabelo. Pentear

18. Estás sempre no gozo; isso é que é gozar. Gozar
19. A pele do meu gato é muito peluda. Peluda
20. Não tenhas receio do cão; não há nada a recear. Recear
21. Ele ganhou o concurso do maior bigode; que grande bigodaça que ele tinha. Bigodaça
22. Comprei uma cautela, hoje de manhã, ao cauteleiro. Cauteleiro
23. A aranha fez uma teia; parece mesmo um tear. Tear
24. A coberta da minha cama está por cima do cobertor. Cobertor

Appendix 4.1 – Stimuli used in the longitudinal study

First spelling session

- 1 - Japonesa. Esta boneca é Japonesa. Japonesa
- 2 - Matreirice. Do que ele gosta é de matreirice. Matreirice
- 3 - Bigodaço. Aquele gigante tinha um grande bigodaço. Bigodaço
- 4 - Passeagem. O meu vizinho só gosta de andar na passeagem. Passeagem
- 5 - Fugisse. Não me apanhavas se eu fugisse. Fugisse
- 6 - Riqueza. O milionário tem uma grande riqueza. Riqueza
- 7 - Aldeamento. Estão a construir um novo aldeamento. Aldeamento
- 8 - Cadearia. O ladrão foi metido na cadearia. Cadearia
- 9 - Chatice. Este filme é uma chatice. Chatice
- 10 - Escocesa. A Maria gostava de ser Escocesa. Escocesa
- 11 - Decidissem. Era bom se ele se decidisse. Decidissem
- 12 - Colmeador. Quem cuida das casas das abelhas é o colmeador. Colmeador
- 13 - Cabriolar. Aqueles meninos andam sempre a cabriolar. Cabriolar
- 14 - Tagarelice. Quando é que param com essa tagarelice? Tagarelice
- 15 - Franqueza. Podes falar com toda a franqueza. Franqueza
- 16 - Rugisse. Eu fugia se o leão rugisse. Rugisse
- 17 - Meiguice. Tu gostas muito de meiguice. Meiguice
- 18 - Tamboreiro. Na orquestra tocava um excelente tamboreiro. Tamboreiro
- 19 - Abrisse. Entrava em casa se a porta se abrisse. Abrisse
- 20 - Pobreza. Ninguém deve viver na pobreza. Pobreza
- 21 - Marotola. Quem fez esta gracinha é um grande marotola. Marotola
- 22 - Destruísse. Faria um castelo se o mar o não destruísse. Destruísse

- 23 - Fornada. O padeiro já coseu outra fornada. Fornada
- 24 - Beleza. Esta pintura tem uma grande beleza. Beleza
- 25 - Asseado. O meu primo não é muito asseado. Asseado
- 26 - Ferisse. Não gostava que o menino se ferisse. Ferisse
- 27 - Baronesa. O que ela queria era ser baronesa. Baronesa
- 28 - Distraísse. Podias enganar-te se te distraísse. Distraísse
- 29 - Princesa. Ela era linda como uma princesa. Princesa
- 30 - Parvoíce. Tu disseste uma grande parvoíce. Parvoíce
- 31 - Aromista. Fui comprar perfumes ao aromista. Aromista
- 32 - Francesa. Esta menina é Francesa. Francesa.
- 33 - Divertisse. Gostava muito que ele se divertisse. Divertisse
- 34 - Dureza. O ferro tem uma grande dureza. Dureza
- 35 - Marotice. Acaba-me já com essa marotice. Marotice
- 36 - Negociório. Vamos combinar tudo na sala do negociório. Negociório
- 37 - Calorento. Eu sou muito calorento. Calorento
- 38 - Portuguesa. A Mariana é Portuguesa. Portuguesa
- 39- Maluquice. Isto é que vai aqui uma maluquice. Maluquice
- 40 - Inglesa. Tenho uma professora Inglesa. Inglesa
- 41 - Recear. Vem comigo e não tens nada a recear. Recear
- 42 - Velhice. O meu avô tem uma boa velhice. Velhice
- 43 - Pureza. O diamante tem um alto grau de pureza. Pureza
- 44 - Recreal. Na escola, os meninos brincam no recreal. Recreal
- 45 - Tristeza. Fala comigo se sentires tristeza .Tristeza
- 46 - Duquesa. No palácio vivia uma duquesa. Duquesa
- 47 - Areal. A praia tem um grande areal. Areal
- 48 - Safadeza. Tu só gostas é de safadeza. Safadeza

Second spelling session

- 1 - Bigode. Aquele homem tem um grande bigode. Bigode
- 2 - Bafarice. Ele só quer é fazer bafarice. Bafarice
- 3 - Malideza. Este senhor age com malideza. Malideza
- 4 - Norubesa. Ela nasceu em Noruba e por isso é Norubesa. Norubesa
- 5 - Rafagisse. Quem me dera que ele rafagisse. Rafagisse
- 6 - Colmeia. As abelhas fazem o mel na colmeia. Colmeia
- 7 - Tarofeza. Ele queria brincar com tarofeza. Tarofeza
- 8 - Vanhisse. Eu corria se a cobra vanhisse. Vanhisse
- 9 - Cabriola. Aquela menina é muito cabriola. Cabriola
- 10 - Passeio. Nas férias fui fazer um passeio. Passeio
- 11 - Arlinesa. Se ela vive em Arlina é Arlinesa. Arlinesa
- 12 - Calhapice. Ele tem uma grande calhapice. Calhapice
- 13 - Riladesa. A minha prima mora em Rilade e por isso é Riladesa. Riladesa
- 14 - Gapisse. Era bom se eu gapisse. Gapisse
- 15 - Aldeia. Gosto muito daquela aldeia. Aldeia
- 16 - Valineza. Ela só queria andar com valineza. Valineza
- 17 - Maroto. Aquele miúdo é muito maroto. Maroto
- 18 - Fatabice. Ele não faz senão fatabice. Fatabice
- 19 - Aparuvesa. A menina nasceu em Aparuva; é Aparuvesa. Aparuvesa
- 20 - Tambor. Gosto muito de tocar tambor. Tambor
- 21 - Pafulhesa. A minha casa fica em Pafulha; assim eu sou Pafulhesa. Pafulhesa
- 22 - Butisse. Tu comias se ele butisse. Butisse
- 23 - Calor. Hoje estive muito calor. Calor
- 24 - Malajice. Ele gosta de viver com malajice. Malajice

- 25 - Fageza. Quando o viu ela exclamou: que fageza! Fageza
- 26 - Piralisse. Podias falar se eu piralisse. Piralisse
- 27 - Aroma. O café tem um bom aroma. Aroma
- 28 - Ticeza. Ele só gosta de amigos com ticeza. Ticeza
- 29 - Asseio. Ser limpo é o mesmo que ter asseio. Asseio
- 30 - Paveza. Tu gostavas de nadar com paveza. Paveza
- 31 - Paltice. Ela gostava de se mostrar com paltice. Paltice
- 32 - Cadeia. Se fizeres um crime vais parar à cadeia. Cadeia
- 33 - Aronisse. Eu comia tudo se a mãe aronisse. Aronisse
- 34 - Fapulice. Ela anda sempre na fapulice. Fapulice
- 35 - Patibeza. Ele gosta de jogar com patibeza. Patibeza
- 36 - Negócio. O meu vizinho tem um negócio. Negócio
- 37 - Milachesa. Se ela nasceu em Milache é Milachesa. Milachesa
- 38 - Tagonice. Tu fizeste uma linda tagonice. Tagonice
- 39 - Cafisse. Tu gritavas se ele cafisse. Cafisse
- 40 - Forno. O pão é cosido no forno. Forno
- 41 - Areia. Na praia há muita areia. Areia
- 42 - Pacheza. Ele gosta de comer com pacheza. Pacheza
- 43 - Tarofice. Já vais começar com essa tarofice? Tarofice
- 44 - Aliquesa. A minha avó masceu em Alique; é Aliquesa. Aliquesa
- 45 - Receio. Estou a sentir um pouco de receio. Receio
- 46 - Milafesa. Esta boneca veio de Milafa; logo, é Milafesa. Milafesa
- 47 - Atrabisse. Era bom se ele atrabisse. Atrabisse
- 48 - Recreio. Gosto muito de brincar no recreio. Recreio

Appendix 4.2 - Letter of consent sent to parents explaining the aims and procedures of the longitudinal study

Estudo sobre “O Uso de Informação Morfológica no Desenvolvimento da Escrita”

Ex.mos pais

Venho solicitar a vossa colaboração para que o seu filho ou filha participe no estudo acima referido.

Este estudo faz parte de um processo de Doutoramento em Psicologia em que eu próprio estou envolvido na Universidade de Oxford Brookes, em Inglaterra. O meu nome é João Rosa, sou Psicólogo Educacional (Carteira Profissional número 634, emitida em 1983) e nos últimos 20 anos tenho trabalhado como professor de Psicologia, na Escola Superior de Educação de Lisboa e, antes, na Escola do Magistério Primário de Lisboa.

Pouca investigação existe sobre o desenvolvimento das competências morfológicas na escrita, em Português, sobretudo aquelas palavras que são mais complexas ou que se pronunciam de uma forma e se escrevem de outra. Compreender como e quando podem as crianças entender essas palavras para poder preparar melhor os futuros e actuais professores é o meu objectivo.

Porque é que o seu filho ou filha foi escolhido (a)?

Foram escolhidas à sorte, por mim, 7 crianças em cada uma das classes em que os professores se disponibilizaram para colaborar. Há três escolas e cerca de trinta professores envolvidos. Como eu não conheço as crianças, não há nenhuma razão especial para que o seu filho ou filha tenha sido escolhido (a) para além do facto de eu querer trabalhar com um grupo o mais variado possível de crianças.

Os pais têm alguma obrigação de aceitar?

Não. Os pais são inteiramente livres de autorizar ou não que os seus filhos participem no estudo.

Embora se deseje que isso não aconteça, os pais podem, em qualquer altura, retirar o seu filho ou filha do estudo, se discordarem dos seus procedimentos.

O que é que vai ser necessário?

Vão ser pedidos, ao seu filho ou filha, três tarefas:

1 – Escrita de palavras. Esta tarefa é feita em pequenos grupos e demora cerca de 40 minutos. A lista de palavras é repetida de seis em seis meses, até Maio de 2002. As crianças irão escrever palavras reais e palavras inventadas.

2 – Avaliação de conhecimentos sobre palavras. Esta tarefa é feita individualmente e demora cerca de 10 minutos. Consta de uma espécie de jogo em que a criança adivinha uma palavra, depois de se lhe darem algumas pistas para ela a descobrir. Esta tarefa é feita duas vezes, de seis em seis meses.

3 – Avaliação do desenvolvimento cognitivo. Esta tarefa é feita individualmente e demora cerca de 30 a 40 minutos. Consta de um conjunto de actividades destinadas a avaliar as capacidades gerais de raciocínio da criança. Esta tarefa é feita apenas uma vez.

Nas tarefas individuais as crianças trabalham comigo numa sala à parte, no momento em que os seus professores considerarem mais adequado. No total cada criança dedicará ao estudo cerca de 3 horas e meia, entre Maio de 2001 e Maio de 2002.

O que é que vai ser feito com os dados recolhidos?

Todos os materiais recolhidos junto das crianças são tratados com confidencialidade. O nome das crianças, pais, professores ou escolas nunca será referido. Os resultados deste estudo não têm influência na avaliação que os professores fazem acerca da aprendizagem

das crianças. No final do estudo, far-se-á uma sessão pública numa escola, para apresentação e discussão dos resultados.

As crianças gostam de participar neste tipo de estudos?

De estudos anteriores já efectuados por mim, posso testemunhar que as crianças gostam imenso de participar. As tarefas são agradáveis e diferentes das suas actividades normais. Geralmente as crianças divertem-se enquanto as executam.

Contacto com o responsável do estudo

Em qualquer altura os pais podem contactar comigo através do telefone 214396601, do e-mail jmsrosa@hotmail.com ou mandando um recado pela professora. Terei muito gosto em combinar uma hora que seja conveniente para receber os pais, sempre que necessitem de algum esclarecimento sobre a forma como o estudo é conduzido.

Não hesite em me contactar para qualquer esclarecimento que julgue necessário.

Não há melhor forma de desenvolver os conhecimentos científicos sobre a aprendizagem da escrita senão pedindo a generosa colaboração dos professores e das crianças e a compreensão dos pais destas.

A sua participação é extremamente importante.

Os meus muito sinceros agradecimentos, com os melhores cumprimentos.

Tercena, 9 de Maio de 2001

(João Rosa)

Por favor, preencha este cupão e peça ao seu filho ou filha para o entregar à professora, nos próximos dias.

Dou autorização ☐ Não autorizo ☐
que o meu filho(a) _____ participe no estudo
sobre “O Desenvolvimento da Escrita”, conforme o que me foi acima explicado.

Os Pais

Appendix 4.3 - Letter sent to teachers explaining the aims and procedures of the longitudinal study

Estudo sobre “O Uso de Informação Morfológica no Desenvolvimento da Escrita”

Ex.mo colega

Venho solicitar a sua colaboração para que algumas crianças ao seu cuidado participem no estudo acima referenciado.

Este estudo faz parte de um processo de Doutoramento em Psicologia em que eu próprio estou envolvido na Universidade de Oxford Brookes, em Inglaterra. O meu nome é João Rosa, sou Psicólogo Educacional (Carteira Profissional número 634, emitida em 1983) e nos últimos 20 anos tenho trabalhado como professor de Psicologia, na Escola Superior de Educação de Lisboa e, antes, na Escola do Magistério Primário de Lisboa.

Pouca investigação existe sobre o desenvolvimento das competências morfológicas na escrita, em Português. Comparada com outras línguas europeias, a escrita em Português, é, por exemplo, mais complexa que o Espanhol e mais simples que a escrita Inglesa. As crianças espanholas têm poucos problemas com a representação as vogais porque estas se escrevem tal como se pronunciam. Em Português a estrutura das vogais é muito complexa. Por exemplo a palavra ‘exposição’ têm um [e] inicial que, na linguagem coloquial, não se pronuncia e um [o] medial que se pronuncia como se fosse um [u]. Muitas crianças escrevem ‘cantor’ como [cator] porque a representação das vogais nasais parece ser particularmente complexa. O final de palavras como ‘pentear’ e ‘aliviar’ não poderá ser distinguido se as crianças se basearem apenas no padrão usado na linguagem oral que não discrimina as duas grafias. No entanto, não existem na escrita em Português algumas complexidades como escrever [ight] para algo que na pronúncia se parece com /ait/ como na palavra inglesa ‘night’ que significa ‘noite’.

Este estudo é longitudinal, isto é, o desenvolvimento da escrita das crianças vai ser acompanhado durante cerca de um ano, entre Maio de 2001 e Maio de 2002.

Como é que as crianças vão ser escolhidas?

Serão escolhidas à sorte, por mim, 7 ou 8 crianças em cada uma das classes em que os professores se disponibilizarem para colaborar. Há três escolas e cerca de trinta professores envolvidos. Como eu não conheço as crianças, não há nenhuma razão especial para que esta ou aquela criança seja escolhida. Pretende-se ter uma amostra aleatória composta por crianças com todos os níveis de aprendizagem. A escolha das crianças depende igualmente da autorização expressa dos pais.

No entanto, serão excluídas à partida, as crianças que não tenham o Português como língua materna ou que tenham déficits sensoriais ou cognitivos que lhes dificultem a aprendizagem.

Os professores têm alguma obrigação de colaborar?

Não. Os professores são inteiramente livres de colaborar ou não no estudo.

O que é que vai ser necessário?

Todo o trabalho necessário para o estudo será executado por mim. Não há qualquer sobrecarga para os professores. O que se pede aos professores é que disponibilizem cada criança ou um pequeno grupo de crianças para trabalhar comigo, durante o tempo lectivo normal.

Vão ser pedidas três tarefas às crianças:

1 – Escrita de palavras. Esta tarefa é feita em pequenos grupos, fora da sala, e demora cerca de 40 minutos. É dividida por dois dias consecutivos. A lista de palavras é repetida de três em três meses, até Maio de 2002. As crianças irão escrever palavras reais e palavras inventadas.

2 – Avaliação de conhecimentos sobre consciência morfológica. Esta tarefa é feita individualmente e demora cerca de 10 minutos. Consta de uma espécie de jogo em que a criança faz analogias verbais. Esta tarefa é feita duas vezes, de seis em seis meses. Num

exemplo simples, serão ditas à criança a sequência de palavras ‘amigo – amiga’ e depois ‘pastor - ?’ para que a criança responda com ‘pastora’.

3 – Avaliação do desenvolvimento cognitivo. Esta tarefa é feita individualmente e demora cerca de 30 a 40 minutos. Consta de um conjunto de actividades destinadas a avaliar as capacidades gerais de raciocínio da criança. Esta tarefa é feita apenas uma vez, no início do estudo. Tem como principal finalidade distinguir estatisticamente as diferenças explicadas pela inteligência como competência geral e por uma competência mais específica, a saber, a consciência morfológica.

No total cada criança dedicará ao estudo cerca de 3 horas e meia, em média, durante um ano civil, entre Maio de 2001 e Maio de 2002.

O que é que vai ser feito com os dados recolhidos?

Todos os materiais recolhidos junto das crianças são tratados com confidencialidade. Toda a informação será tratada numericamente. O nome das crianças, pais, professores ou escolas nunca será usado por forma a permitir identificar quaisquer pessoas .

Parte-se do princípio que trinta professores usarão métodos e processos de ensino específicos, mas o enfoque é a forma como as crianças, em geral, desenvolvem os processos de escrita e não como estes são ensinados.

Não se espera que alguns dos processos morfológicos em estudo sejam plenamente usados pelas crianças, mesmo no final do quarto ano de escolaridade. Em geral as palavras serão classificadas como correctas se a marca morfológica em estudo estiver presente, independentemente de outros erros que a palavra possa conter.

Comunicação de resultados

Entre outras formas, disponibilizo-me para, no final do estudo, fazer uma sessão pública de apresentação e discussão dos resultados.

Contacto com o responsável do estudo

Em qualquer altura os professores podem contactar comigo pessoalmente na escola e também através do telefone 214396601 ou do e-mail jmsrosa@hotmail.com

Estou certo que compreenderão a necessidade deste estudo e de que poderei contar com a vossa compreensão.

Os meus muito sinceros agradecimentos, com os melhores cumprimentos.

Tercena, 9 de Maio de 2001

(João Rosa)

Appendix 4.4:

Letter of educational
authorities authorising
data collection in schools



Exmº Sr.
Dr. João Manuel Santos Rosa
Rua Padre Anchieta nº 6

2745 Tercena

Sua referência:

Sua comunicação de:

Nossa referência:

Data

GAB 30.DEZ 98 46033 -

ASSUNTO:

Na sequência do V.fax de 98/12/28, informo que a DREL nada tem a opôr à recolha de dados desde que haja concordância do órgão de gestão das escolas e dos encarregados de educação.

Com os melhores cumprimentos, e um abraço

A Directora Regional Adjunta

Isabel Simões de Oliveira

Na resposta indicar a referência e a data deste ofício

Oxford Brookes University

School of Social Sciences and Law

Research Ethics Review Checklist

This checklist should be completed for every research project which involves human participants. It is used to identify whether a full application for ethics approval needs to be submitted. If a full application is required, a form E2/SS&L should be used.

Before completing this form, please refer to the University Code of Practice on Ethical Standards for Research Involving Human Participants. The principal investigator or, where the principal investigator is a student, the supervisor, is responsible for exercising appropriate professional judgement in this review.

This checklist must be completed before potential participants are approached to take part in any research.

Section I: Applicant Details

1. Name of Researcher (applicant):	Joao Manuel dos Santos Rosa
2. Status (please click to select):	MPhil/PhD Student
3. Email Address:	jmsrosa@hotmail.com / 99117039@brookes.ac.uk
4a. Contact Address:	Rua Padre Anchieta, 6 - 2745-596 Barcarena (Portugal)
4b. Telephone Number:	00351 21 4396601 (Pt.) 01865 48 4941 (Brookes)

Section II: Project Details

5. Project Title:	The development of spelling and its relation with morphological awareness: the case of Portuguese
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Section III: For Students Only:

6. Module name and number or MA/MPhil course and department:	
7. Supervisor's or module leader's name:	Professor Terezinha Nunes
8. Email address:	tnunes@brookes.ac.uk
9. Contact address:	Department of Psychology - Oxford Brookes University, Gipsy Lane, Headington; Oxford OX3 0BP

Supervisor: Please tick the appropriate boxes:

<input checked="" type="checkbox"/>	The student has read the University's Code of Practice
<input checked="" type="checkbox"/>	The topic merits further research
<input checked="" type="checkbox"/>	The student has the skills to carry out the research
<input checked="" type="checkbox"/>	The participant information sheet or leaflet is appropriate
<input checked="" type="checkbox"/>	The procedures for recruitment and obtaining informed consent are appropriate

Comments from supervisor: *There are no major ethical concerns with this project. T. Jones*

Section IV: Research Checklist

Please answer each question by ticking the appropriate box:

	YES	NO
1. Does the study involve participants who are particularly vulnerable or unable to give informed consent? (e.g. children, people with learning disabilities, your own students)	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. Will the study require the co-operation of a gatekeeper for initial access to the groups or individuals to be recruited? (e.g. students at school, members of self-help group, residents of nursing home)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
3. Will it be necessary for participants to take part in the study without their knowledge/consent at the time? (e.g. covert observation of people in non-public places)	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4. Will the study involve discussion of topics which the participants would find sensitive (e.g. sexual activity, own drug use)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5. Are drugs, placebos or other substances (e.g. food substances, vitamins) to be administered to the study participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
6. Will blood or tissue samples be obtained from participants?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7. Is pain or more than mild discomfort likely to result from the study?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8. Could the study induce psychological stress or anxiety or cause harm or negative consequences beyond the risks encountered in normal life?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
9. Will the study involve prolonged or repetitive testing?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10. Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?	<input type="checkbox"/>	<input checked="" type="checkbox"/>

11. Will the study involve recruitment of patients or staff through the NHS?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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If you have answered ‘no’ to all questions, send the completed and signed form E1/SS&L to your Department’s representative on the School Research and Consultancy Committee, for their records. Undergraduate and MA students should retain a copy of the form and submit it with their research report or dissertation (bound in at the beginning). Work which is submitted without the appropriate ethics form will be returned unassessed. MPhil/PhD students should submit a copy to the Research Degrees Board with their application for Registration, and forward a copy to the School Research Ethics Officer. Members of staff should send a copy to the School Research Ethics Officer

If you have answered ‘yes’ to *any* of the questions in Section IV, you will need to describe more fully how you plan to deal with the ethical issues raised by your research. This does not mean that you cannot do the research, only that your proposal will need to be approved by the School Research Ethics Officer or Committee. You will need to submit your plans for addressing the ethical issues raised by your proposal using the ethics approval application form E2/SS&L, which should be sent to the School Research Ethics Officer. Form E2/SS&L can be obtained from the School web site.

If you answered ‘yes’ to *question 11*, you will *also* have to submit an application to the appropriate external health authority ethics committee, *after* you have received approval from the School Research Ethics Officer. For research conducted in Oxfordshire, applications to the Applied and Qualitative Research Ethics Committee must be signed by the School Research Ethics Officer before they are submitted. Information on how to obtain this form is also available on the School web site.

Please note that it is your responsibility to follow the University’s Code of Practice on Ethical Standards and any relevant academic or professional guidelines in the conduct of your study. This includes providing appropriate information sheets and consent forms, and ensuring confidentiality in the storage and use of data. Any significant change in the question, design or conduct over the course of the research should be notified to the School Research Ethics Officer and may require a new application for ethics approval.

NOTE: All materials submitted will be treated confidentially. When any doubt arises in relation to the above, always forward your proposal to the School Research Ethics Officer.

Signed: *[Signature]* Principal Investigator
Signed: *Terezinha Nunes* Supervisor or module leader (where appropriate)
Date: *04/2000*

Oxford Brookes University
School of Social Sciences and Law

Application for ethics approval for research involving human participants

Before completing this form, the Ethics Review Checklist Form E1/SS&L should have been completed to establish whether a full Application for Ethics Approval is required. If it is required, this form should be completed by the principal investigator or, where the principal investigator is a student, by the student and supervisor. Before completing this form, please refer to the University Code of Practice on Ethical Standards for Research involving Human Participants and any guidelines provided by academic or professional associations.

Completed and signed application forms should be sent to the School Research Ethics Officer for consideration by the School Research Ethics Sub-Committee. The School Research Ethics Officer will complete form E3/SS&L indicating the decision and forward it to the applicant. Undergraduate and MA students should submit Form E3/SS&L with their research report or dissertation (bound in at the beginning). Work which is submitted without the appropriate ethics form will be returned unassessed.

Research ethics approval must be obtained before potential participants are approached to take part in any research.

Section I: Applicant Details

1. Name of Researcher (applicant):	Joao Manuel dos Santos Rosa
2. Status (please click to select):	MPhil/PhD Student
3. Email Address:	jmsrosa@hotmail.com / 99117039@brookes.ac.uk
4a. Contact Address:	Rua Padre Anchieta, 6 2745-596 Barcarena (Portugal)
4b. Telephone Number:	00351 21 4396601 (Pt.) / 01865 48 4941 (Brookes)

Section II: Project Details

5. Project Title:	The development of spelling and its relation with morphological awareness: the case of Portuguese
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Section III: For Students Only:

6. Module name and number or MA/MPhil course and department:	
7. Supervisor's or module leader's name:	Professor Terezinha Nunes
8. Email address:	tnunes@brookes.ac.uk

9. Contact address:	Department of Psychology - Oxford Brookes University, Gipsy Lane, Headington; Oxford OX3 OBP
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Section IV: Summary of Proposed Research

9. Background and rationale for study:	
<p>In many alphabetic languages there are some words that can be spelled by directly matching the sounds with the corresponding letters that represent them - a direct phoneme-grapheme route.</p> <p>Studies on the development of spelling have, however, identified some situations in which children have to rely on morphology in order to spell some words accurately.</p> <p>This is when there is more than one possible representation for the same sound, when there are conventional morphemes that flout letter-sound correspondence rules and when some morphemes have to be spelled, despite the fact that they are silent in the pronunciation. On the other hand, some developmental studies have shown that there is a close relation between spelling development and the development of a metalinguistic ability, morphological awareness.</p> <p>Research for the European Variant of Portuguese is almost non-existent either on how children develop the use of morphological spelling strategies or how morphological awareness is related to such development.</p> <p>The studies that are going to be undertaken attempt to fill in this gap and provide evidence that can be useful in both theoretical and educational contexts. The focus will be, firstly, the spelling of stems in base and derived words, when the stems in the latter words are non-transparent; secondly, how the processes of differentiation of suffixes that are homophone but spelled differently according to their grammar function develops; thirdly, how morphological awareness develops and what relation exists with the development of spelling.</p>	
10. Aims and objectives of the research or the research question:	
<p>Aims:</p> <ul style="list-style-type: none">1 - Examine whether and from when can children incorporate morphological considerations in their spelling;2 - Examine how consistency in the spelling of stems in base and derived words develops;3 - Examine how differentiation in the spelling of homophone suffixes develops;4 - Examine how morphological awareness develops and its relation with achievement in the spelling of morphologically related stems and homophone morphemes. <p>Objectives:</p> <ul style="list-style-type: none">1 - Find out which developmental trends underlye these issues;2 - Identify suitable ways to study children's spelling processes.	
11. Methods of data collection :	
<p>(Please briefly outline how data will be collected and attach a copy of any questionnaires, interview schedules or observation guidelines to be used.)</p>	

All the data will be collected in Primary schools in the greater Lisbon area in Portugal. All the schools will be state supported to allow for greater socio-economic variability. This is because around 85 % of compulsory primary school education in Portugal is the responsibility of the state educational authorities.

Spelling tasks and morphological awareness measures will be used. In one of the studies, a longitudinal study, children will be assessed for IQ with a standardised version of WISC. All studies will involve different participants coming from 5 different schools. Randomised sampling processes will be used.

13. Recruitment of participants:

(Please outline the number of participants involved; how potential participants will be identified and invited to take part in the study; and how informed consent will be obtained)

All schools involved in the studies will volunteer to participate. Decisions about the meaningfulness of the studies in each school will be asked by the experimenter from each 'educational council' in each school.

It is expected that around 1000 children will be involved. The studies require that only children whose first language is (European) Portuguese be involved. Children with statements for sensory or cognitive impairments will not participate, too.

The experimenter will randomly allocate individual children or groups of children to different conditions.

In a cross-sectional study in which children will only have to spell a few words, the schools' educational councils will be consulted on whether informed consent from parents will be required. In a longitudinal study where confidential data such as IQ is going to be collected informed consent from parents will be sought.

14. Please attach a copy of your information sheet and, if appropriate, your consent form.

☒ Attached

15. Potential adverse effects and steps to deal with them:

(Please outline any potential psychological stress, anxiety or upset or any harm or negative consequences which may be induced by the study and the steps to be taken to address them.)

Children will be invited to participate and explained that the experimenter's aim is to understand how they learn to spell some words. They will be told that young and older children will be involved because it is not expectable that everything is mastered earlier or. Children will be asked to perform as well as they can but no feedback will be given about the extent of correctness or incorrectness. This will avoid major feelings of anxiety from what a child may consider to be bad performance. Children will also be told that all the data will be handled by the experimenter and that their performance will have no effect on school marks. All children will be praised for their participation.

Some teachers may feel that the experimenter has an hidden aim of evaluating their teaching methods. In order to address that feeling, each teacher will be briefed individually about the aims and methods of the study. Confidentiality about all the data collected will be reassured. The sampling of children in each classroom and grade will be done by the experimenter in the presence of the teacher, so that no doubts exist as to the fairness of the process. The experimenter will offer a meeting, at the end of the study, opened to all teachers, in which the background, the results and conclusions will be presented and discussed.

Some parents may feel that if their child was selected to participate in a study, perhaps he / she has a learning problem. In order to avoid that, each family will receive a written description of the study's aims, with a clear explanation about the sampling methods, how the data is going to be gathered, assurance about confidentiality and be asked to sign a consent form, should they agree to let their children participate. The interest in their children participation as a way to enhance knowledge on developmental issues will be stressed. The experimenter will provide relevant contact details so that personal enquiries should be easy. It will be explained that parents are free to refuse participation or withdraw their children from the study, at any moment, should they disagree with the procedures involved.

16. Potential benefits of proposed research:
(Please outline the benefits of the research for participants involved and more generally)

Adding to the knowledge of how children develop morphological spelling strategies in a language for which so little is known is, in many ways, crucial.

Firstly, it is important to examine whether developmental processes that have been identified in other alphabetic languages can be replicated in Portuguese. This will add to cross-linguistic evidence, necessary to develop comprehensive theoretical models of spelling development.

Secondly, the studies will provide evidence on developmental processes that are necessary to develop better teacher training and to inform curriculum design and the quality of educational resources.

Thirdly, this research may stimulate Portuguese institutions and researchers in different areas to establish a sustainable research approach on children's literacy development.

17. Steps to be taken to ensure confidentiality of data:
(Please outline steps to ensure confidentiality, privacy and anonymity of data during collection, storage and publication.)

During collection: No data will be made available to anyone, children, teachers or parents. It will be explained to teachers that the tasks are research instruments that in no case are suitable to be used in direct school activities. No instrument will be made available and the experimenter will make sure that no copies of them will be issued.

Storage and publication: Children's protocols will be kept on a safe place and for the time judged necessary. All data will receive statistical coding. No names of individual children, teachers or parents will be used in any published materials. If any of the data is used to exemplify developmental processes at scientific meetings, confidentiality will always be assured.

Section V: Funding

18. Please indicate source of research funding:

<input type="checkbox"/>	Internal School/University funds (Please indicate source:)
<input checked="" type="checkbox"/>	External funds (Please indicate source: FCT - Ministry of Science and Technology - Portugal)
<input type="checkbox"/>	As part of degree/training or 'own account' research

Section VI: External Research Ethics Committees

19. Will the study involve recruitment of patients or staff through the NHS?

In Oxfordshire?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Outside Oxfordshire?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

Signed: Principal Investigator (student or staff)

Signed: Supervisor or module leader for student

Date: ...04/2000.....